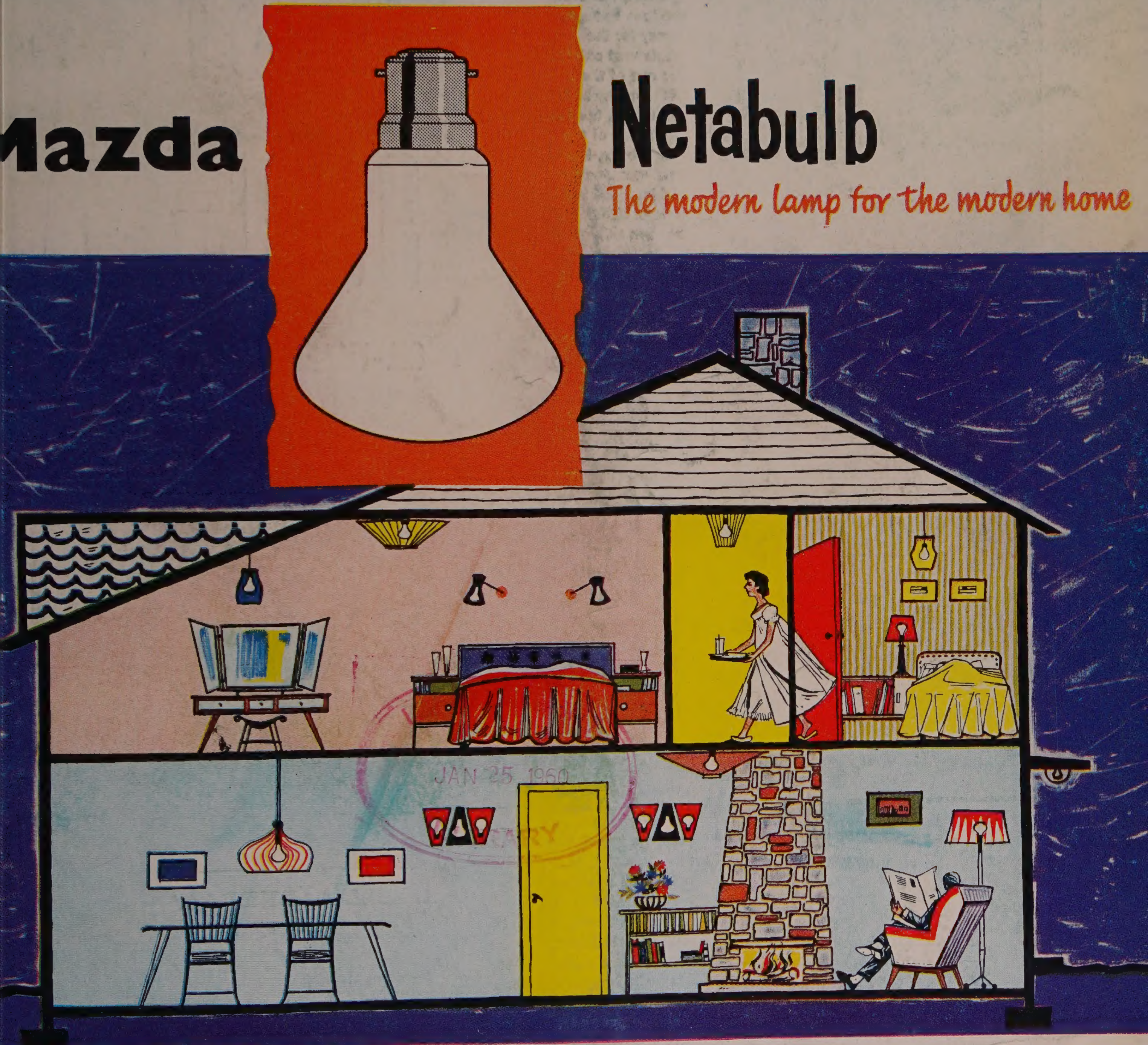
ELECTRICAL REVIEW

FRIDAY
JANUARY 1960

WEEKLY
PRICE 1s 6d


Mazda
Netabulb
The modern lamp for the modern home

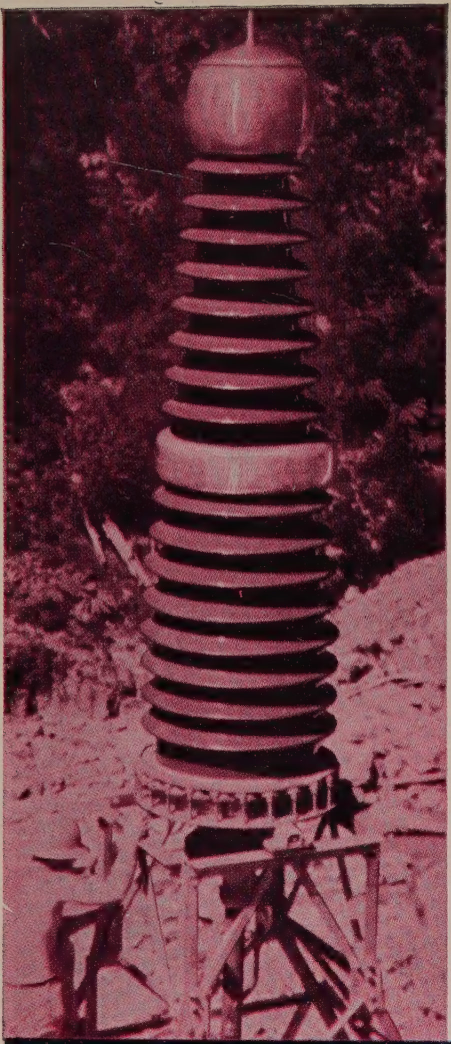
Mazda *lamps stay brighter longer*

AEI
Lamp and Lighting Co Ltd
MELTON ROAD, LEICESTER

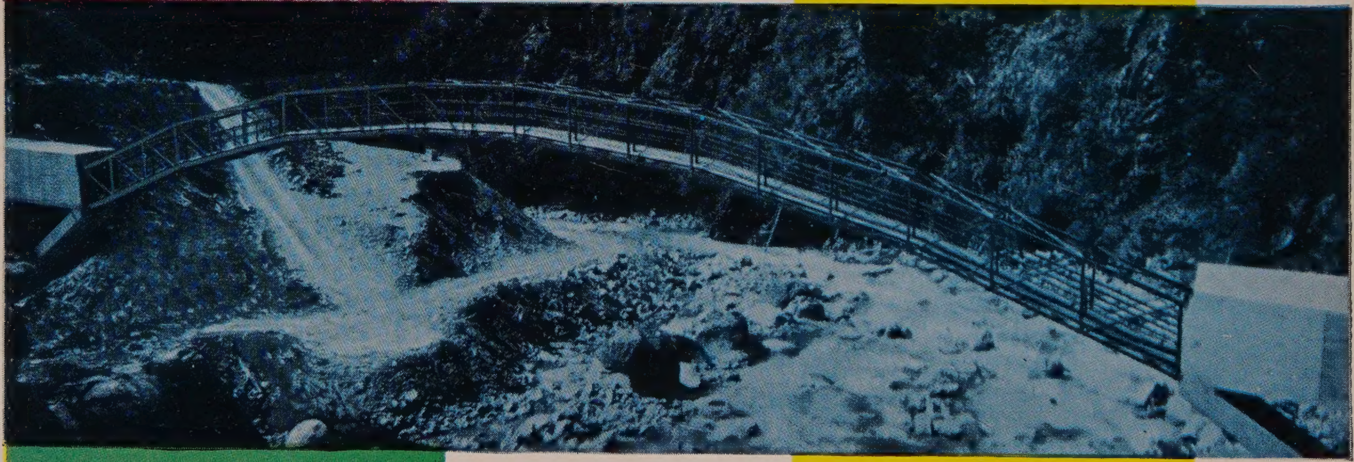
JAN 25 1960

AUSTRALIAN SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY

FIRST with 330kv OIL-FILLED CABLES



In the Snowy Mountains region of Australia, a great river, the Snowy, and its tributary, the Eucumbene, are being diverted from an easterly course to irrigate the western plains of New South Wales and Victoria. On its journey westward this water will fall more than 2,000 ft.—a staggering power potential which, through a chain of hydro electric power stations, will eventually produce enough electricity to pay for the whole vast enterprise. For one of the first of these power stations, the T.1. on the River Tamut, a tributary of the Eucumbene, Pirelli-General have manufactured and installed the highest voltage oil-filled cables ever made in this country. Transmission of power at 330 kV. 3 phase 194 M.V.A. (340 amperes phase) along a tunnelled route from an underground generating station to an outdoor switchyard some 1,600 ft. distant *on the other side of the River Tamut,* proved a formidable undertaking, and the seven cables, all of which were installed in single lengths of 1,625 ft. without intermediate joints, were carried on the bridge shown in the photograph. Pirelli-General are proud to announce that their contract to provide a vital link in this great Commonwealth enterprise has now been completed.

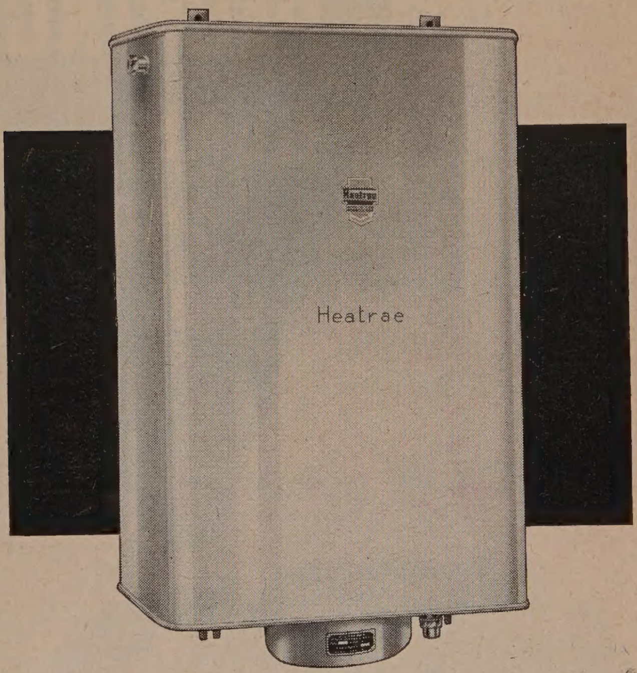


PIRELLI-GENERAL
CABLE WORKS LTD · SOUTHAMPTON

Heatrae

of Norwich

Originators
of Rectangular
cistern type
WATER HEATERS



The F.B. (Flat Back) cistern type, thermostatically controlled Electric Water Heater, is a complete hot water system in itself. It has its own ball valve feed and overflow connection. Stock sizes up to 20 gallons capacity. Larger sizes made to order. This HEATRAE cistern type is a pioneer Electric Water Heater. It occupies minimum space and has small projection. First devised and put on the market in 1924, the F.B. has, of course, been improved from time to time and today is one of our most popular patterns. Catalogue section DE will give you further information. Please ask for one.

Manufacturers of Electric Water Heaters, Oil Heaters, Immersion Heaters, Urns, Towel Rails, Airing Cupboard Heaters, Electric Fires, Flameproof Heating Apparatus, Food Trolleys, Warming Plates, Air Heaters. Specialists in Steam Heated Oil Heaters and Calorifiers for Shipboard.

HEATRAE LIMITED

Pioneers since 1920 in all-electric water heaters

NORFOLK NOR 29A - ENGLAND

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Telephone: NORWICH 25131 (Private Exchange)

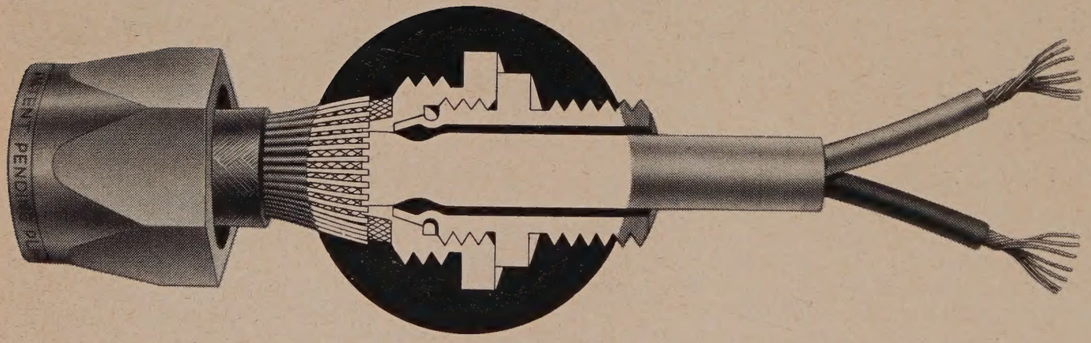
GLAND PACKING GONE FOR GOOD...

Our new, crimped-on glands are absolutely self-sealing !

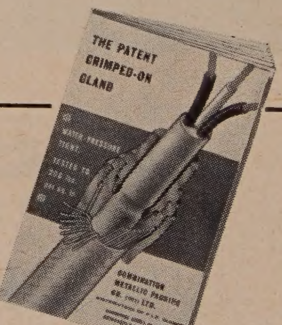
A unique fused-in lead lining crimps the cable as the component parts of the gland are assembled to form a joint that is perfectly watertight !

Because of this—plus the ease of assembly—our glands are matchless in price and performance.

The PLA Gland for Armoured Cable and the PL for Unarmoured, provide 200 lb. per sq. inch water-pressure-tight seal and perfect earth-bonding without any form of packing.



Actual size of ¾″ gland


THE PATENT CRIMPED-ON GLAND
COMBINATION METALLIC PACKING CO. (1921) LTD.

WHATEVER YOUR CABLE WE HAVE THE GLAND

This illustrated brochure details our complete range of glands with performance figures of our PL, PLA, ARM, BWT, PIL and PILA plus the newly-designed ARM moisture-proof. Please send for a copy.

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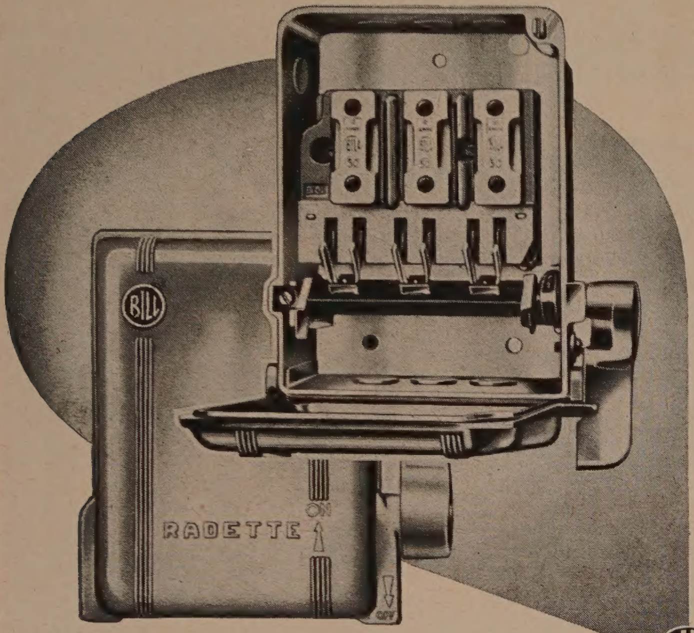

- DESIGNED FOR CONTROLLING SMALL MOTORS NOT EXCEEDING 5 H.P.
- 10 AMPS. 500 VOLTS. 3 PHASE QUICK MAKE AND BREAK SWITCHES.
- AMPLE KNOCKOUTS AND GENEROUS WIRING SPACE PROVIDED. 3–¾" KNOCKOUT HOLES TOP AND BOTTOM. 1–¾" KNOCKOUT HOLE IN LEFT HAND SIDE FOR STARTER CONNECTION.

RADETTE Q1438 T.P. SWITCHFUSE

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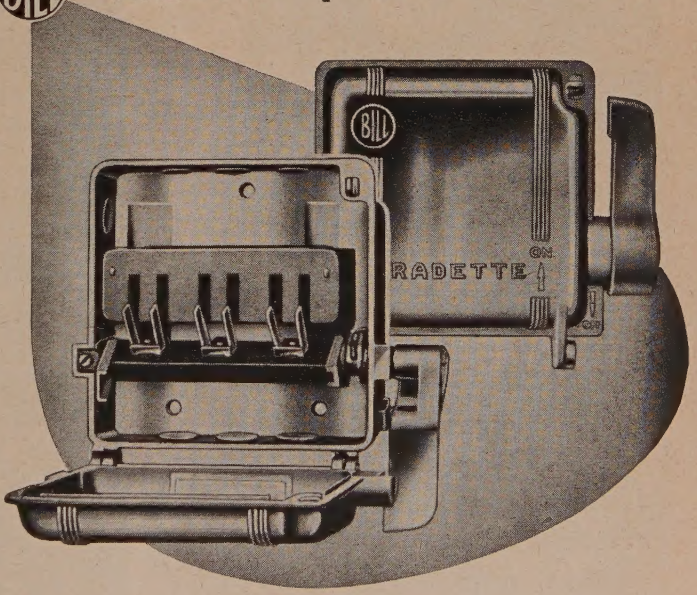
- 'THROUGH' WIRING ARRANGED UNDER THE SWITCH BASES.
- SOLID FORTOL BRUSH BARS TO ELIMINATE EARTHING.
- FINISHED IN BILL SILVERLOSE—A DURABLE STOVED ALUMINIUM ENAMEL.



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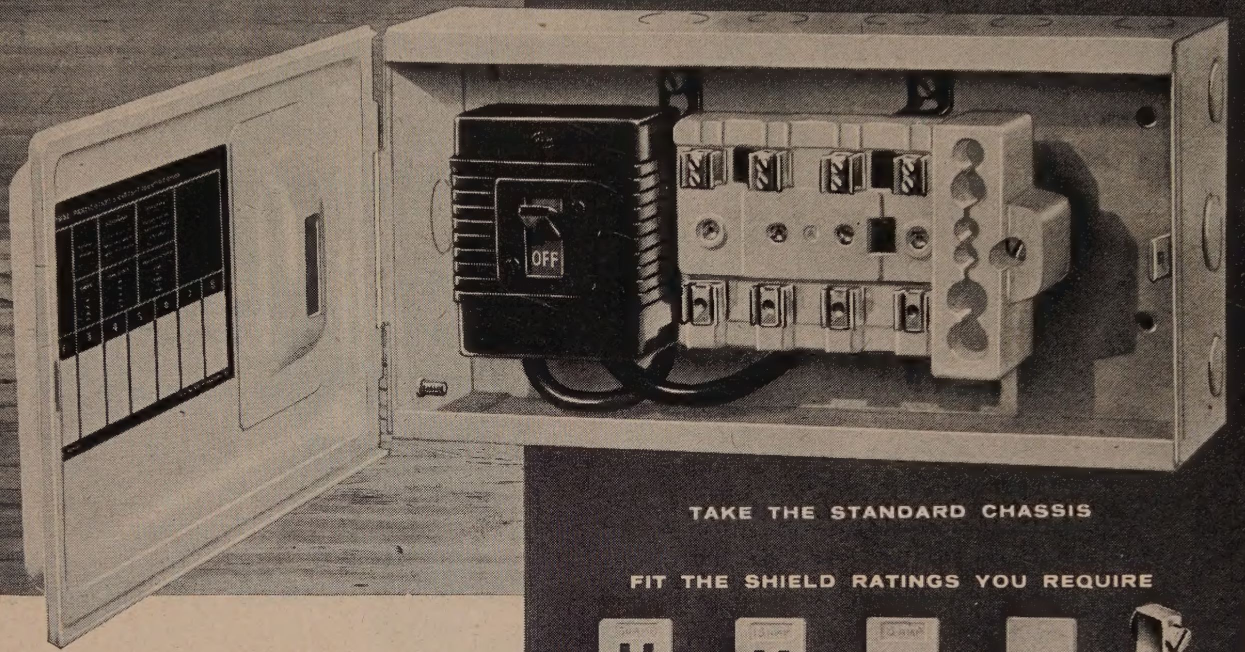
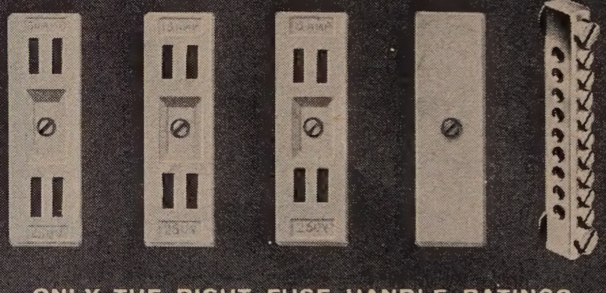
MEMERA the unit which set a new high standard in the industry



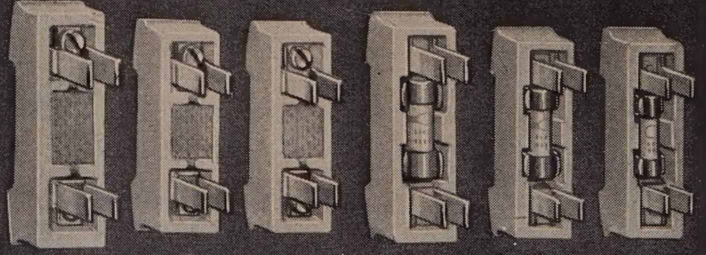
TAKE THE STANDARD CHASSIS

FIT THE SHIELD RATINGS YOU REQUIRE



ONLY THE RIGHT FUSE HANDLE RATINGS WILL THEN FIT

REWIRABLE OR H.R.C.



30 AMP 15 AMP 5 AMP 30 AMP 15 AMP 5 AMP

If the job calls for unusual fuse combinations, it's no trouble at all with Memera. No other equipment gives you the same versatility as Memera.

The system is so delightfully simple. The chassis is the same for all combinations. Just fit the appropriate shields to suit the fuse ratings you need for the job. Once these are fitted, only the correctly rated fuse handles can be inserted.

And of course with Memera there is the big advantage that you can use either rewirable or H.R.C. fuses.

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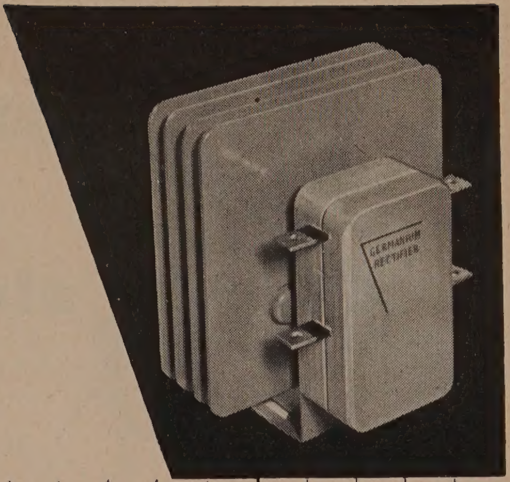
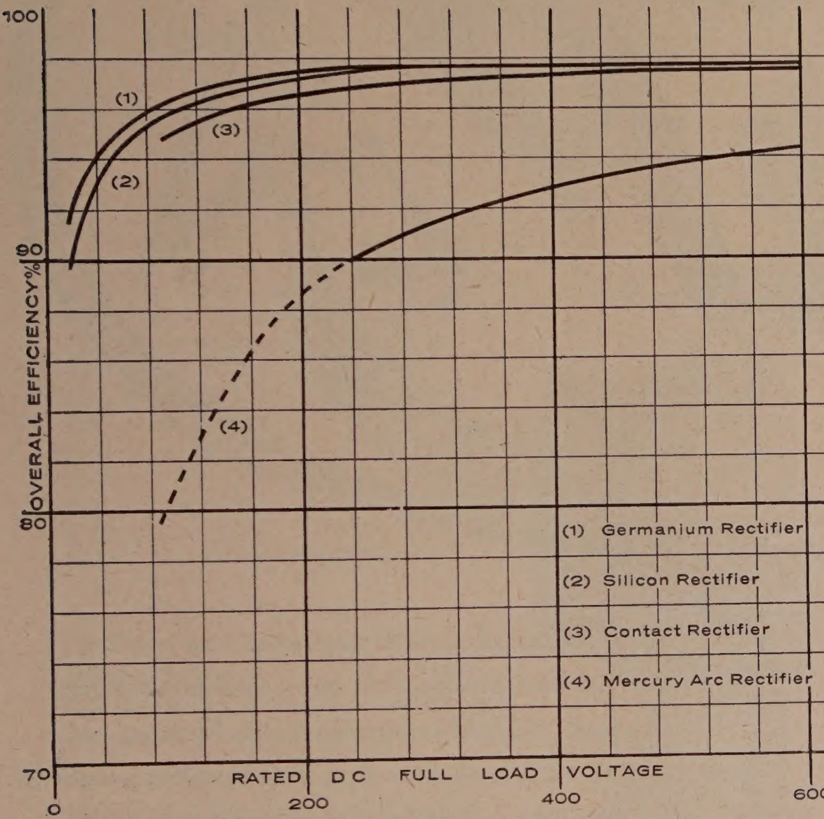
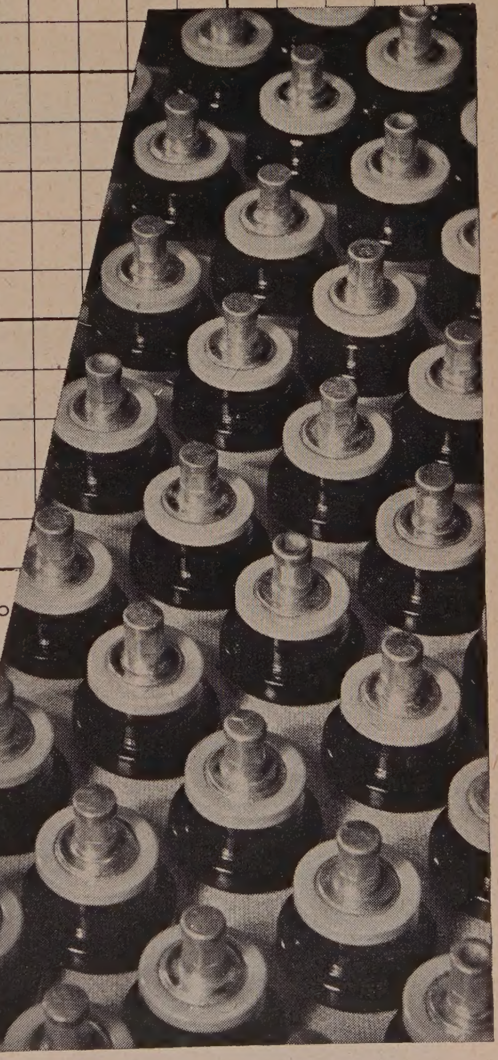
Another good reason for choosing

AEI

SEMICONDUCTOR POWER RECTIFIERS







Semiconductor rectifiers give a bonus in efficiency over other forms of power conversion equipment. The curves show clearly comparative efficiencies of germanium, silicon, mechanical contact, and mercury-arc rectifiers.

The high quality of AEI semiconductor power rectifiers is the result of original research, intensive development, and wide experience of application. Their efficiency in service is matched by outstanding dependability.

Write for further information and technical advice to Power Rectifier Sales, Rugby.

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HEAVY PLANT DIVISION

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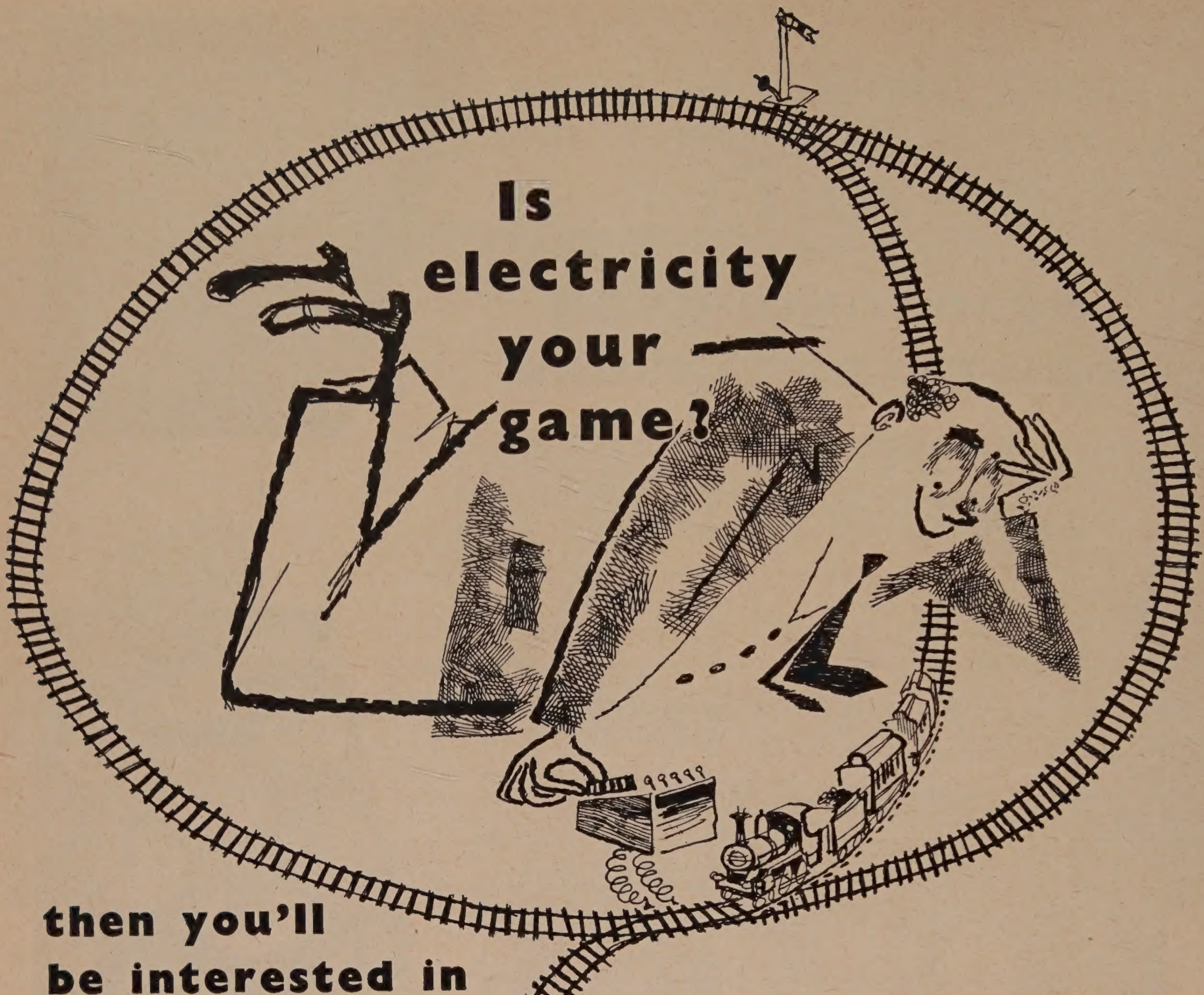
Is electricity your game?



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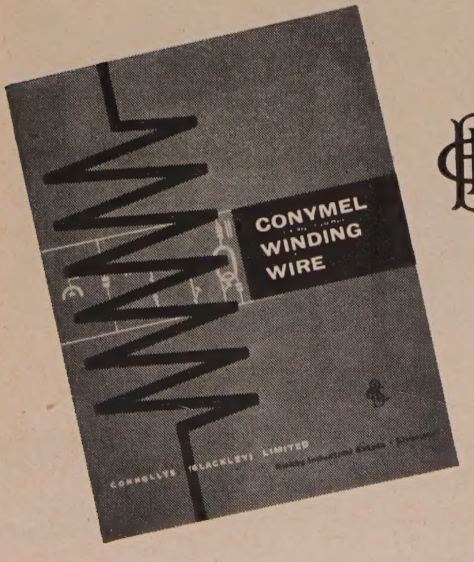
Conymel, an all purpose vinyl acetal base winding wire, has been developed for many applications where toughness of insulation combined with flexibility and resistance to the solvents in impregnating varnishes is essential. Our latest Conymel catalogue gives all possible technical information on this type of wire, and will be of the utmost assistance to Designers and Coilwinders. A copy will gladly be sent free of charge on request.



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Standby lighting, switchgear operating, alarm signalling and electric clock installations.

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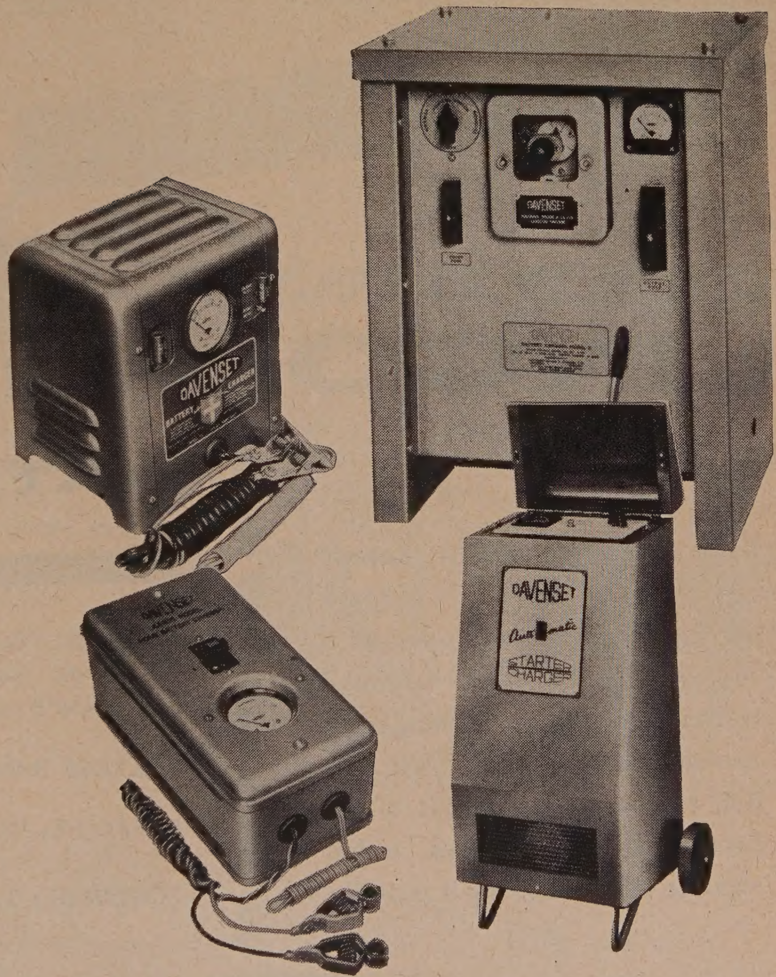
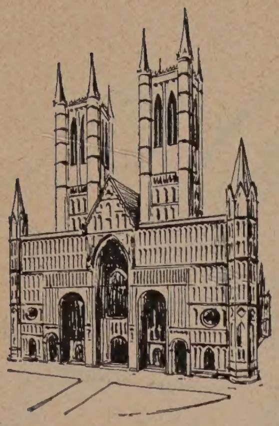
Emergency steering, lighting and alarm signalling.



DAVENSET BATTERY CHARGERS

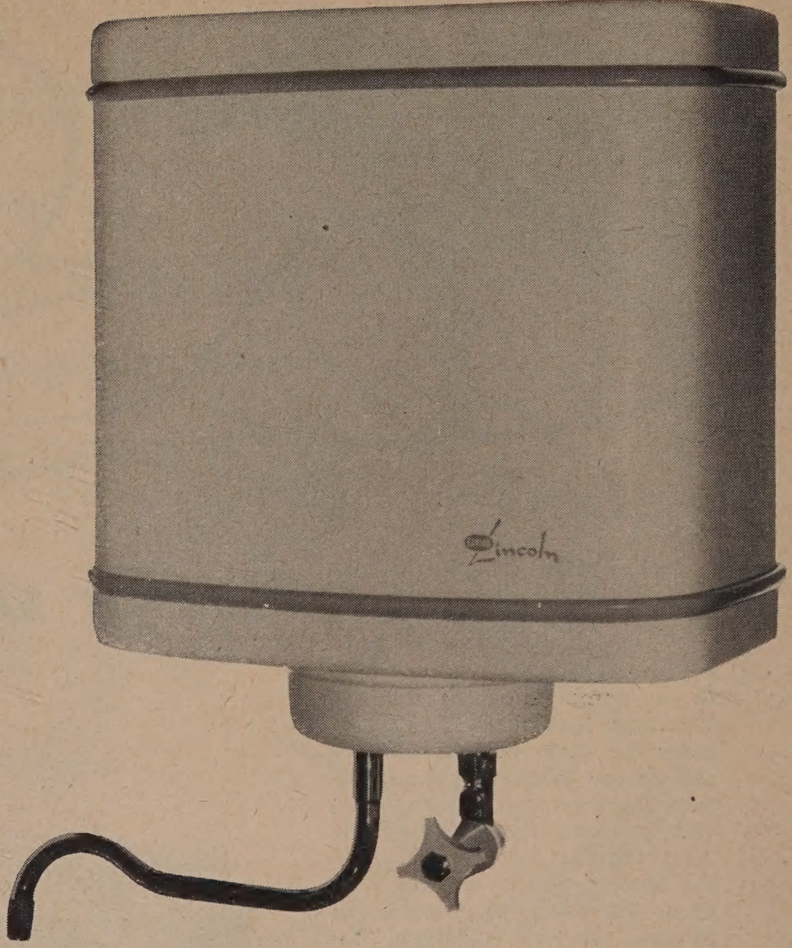
PARTRIDGE WILSON & CO. LTD., DAVENSET ELECTRICAL WORKS, LEICESTER 'Phone 37291/5



A Landmark

Like its namesake the cathedral—which can be seen for miles around—this new Santon heater is also something of a landmark; but a landmark for traders not travellers.

Give it a chance and it will guide you to record sales in a highly competitive market—a market in which the traditionally high standards associated with the name of Santon count for a good deal.



The 'LINCOLN' *Thermal Storage* WATER HEATER

This completely new heater combines all Santon's modern manufacturing techniques with the latest 'Stelvetite' abrasion resistant finish. The '*Lincoln*' is, of course, completely automatic, and, due to the studied layout of the heater plate and unions, either right *or* left hand fixing is possible.

FINISHES: White or cream 'Stelvetite' with Guardsman Red Bands. Dresden Blue or Middy Blue Bands can be supplied if requested.

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CAPACITY: Within 3 pints of 3 gallons.

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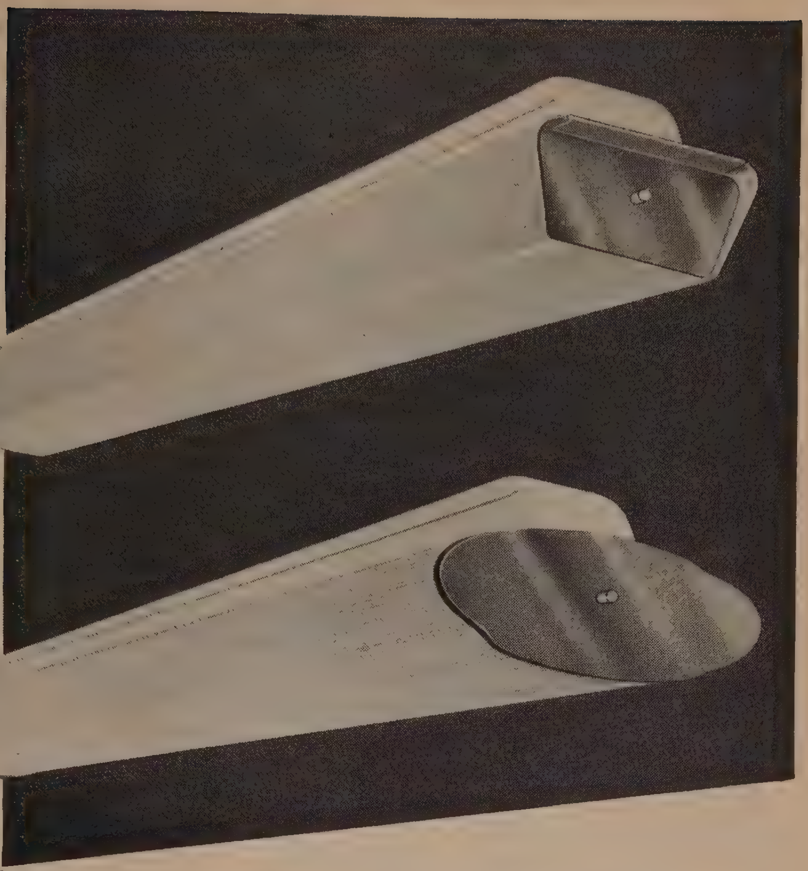
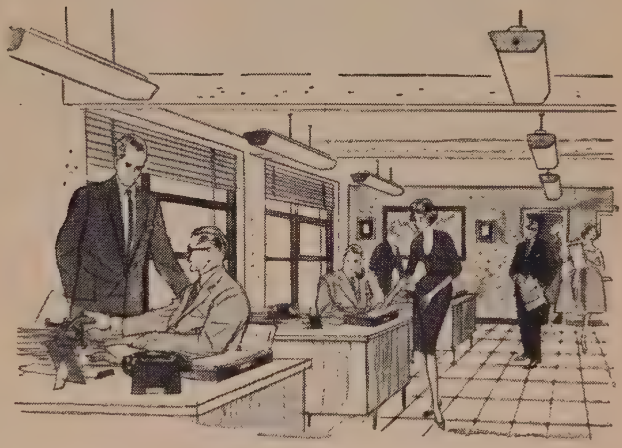
New lighting décor by



BENJAMIN REGD. *Litemaster*

Now . . . in one sweep . . . Benjamin brings new elegance in lighting to offices, entrance halls, restaurants and leisure areas. 'Litemaster' couples the proved efficiency and economy of 'Taskmaster' fluorescent fittings with outstanding contemporary design which, in addition to blending with any modern decorative scheme, offers new inspiration in the field of décor.



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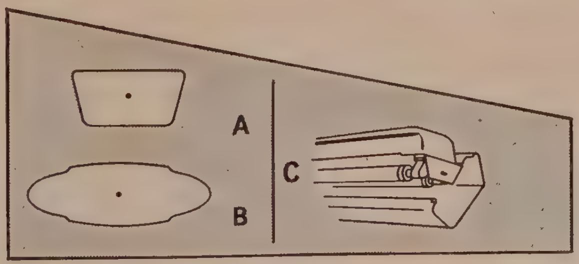

Four sizes:
1 x 4ft.40-watt lamp.
1 x 5ft.80-watt lamp.
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2 x 5ft.80-watt lamps.

better lighting by BENJAMIN REGD.

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2 AMP. 3 PIN SOCKET OUTLET
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5 AMP. S.P. ONE WAY SWITCH
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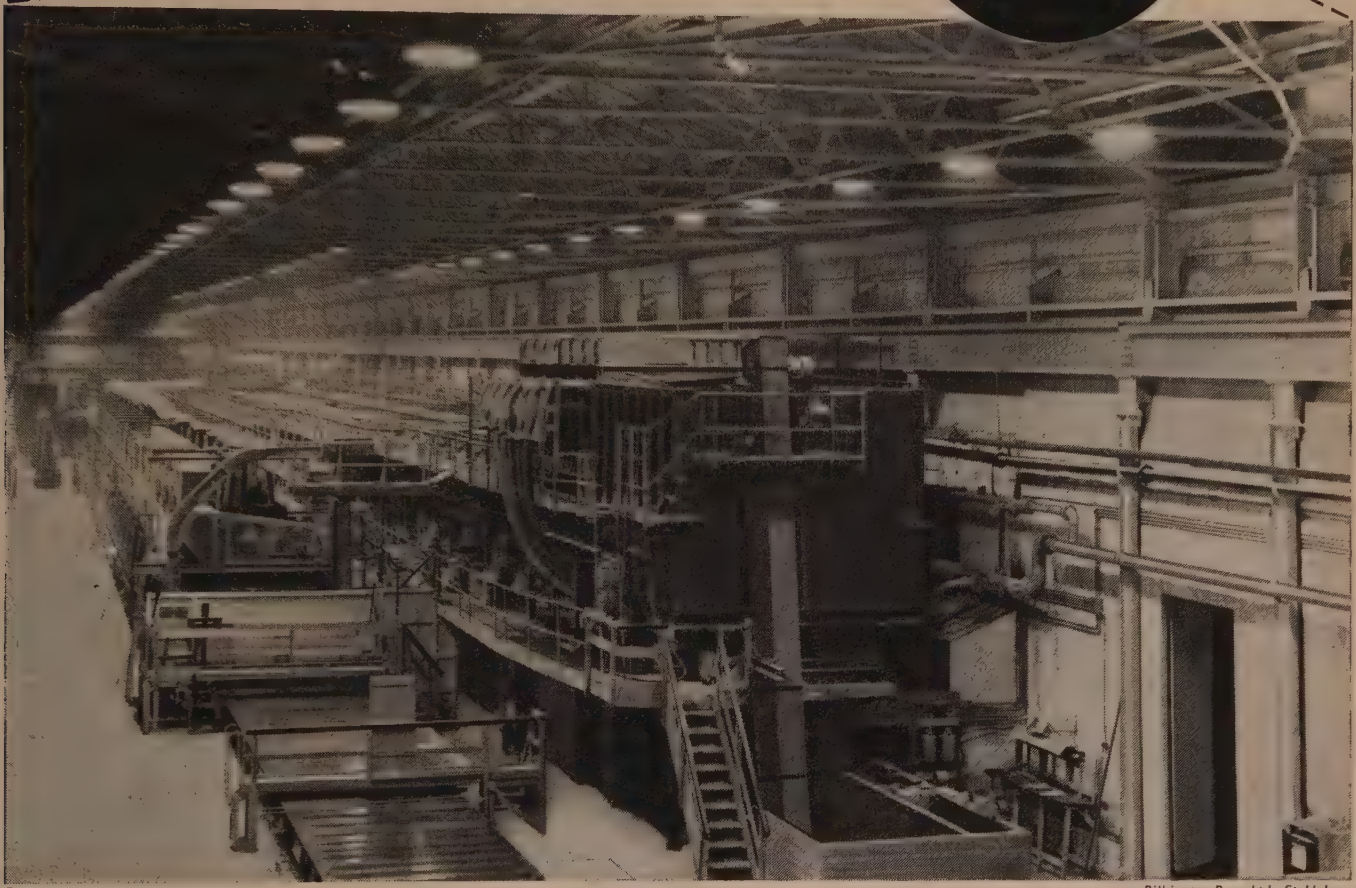

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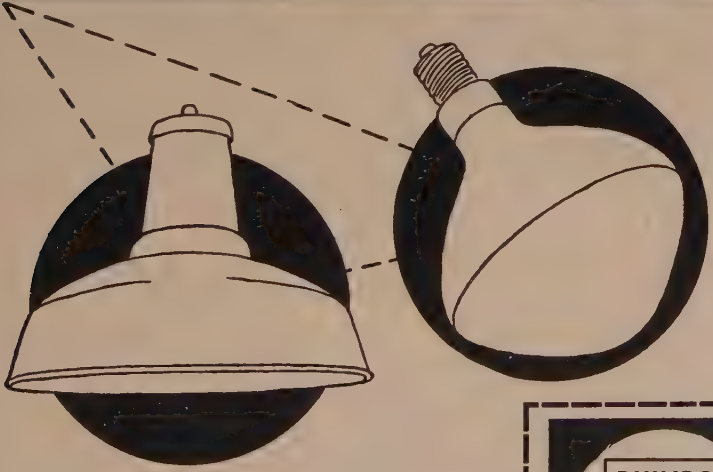

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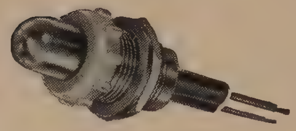
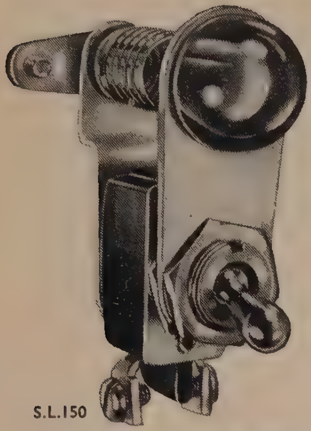
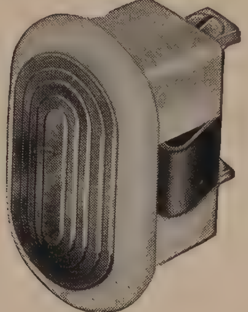
S.L.162


S L.160

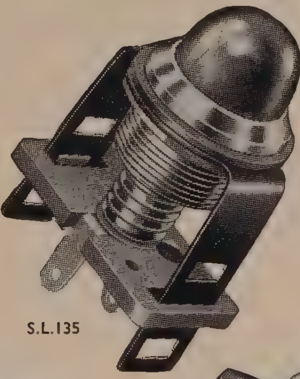

S.L.150

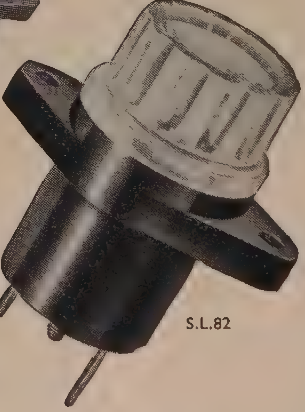

S.L.50

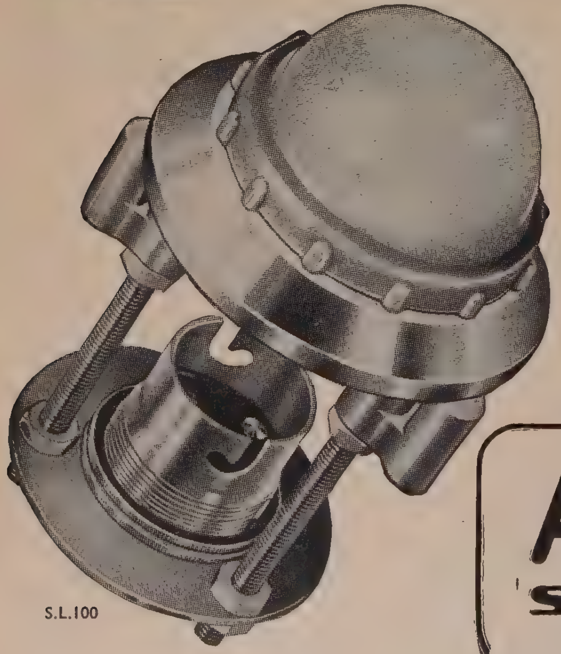
S.L.130

S.L.90/SB

S L.86


S.L.135


S.L.82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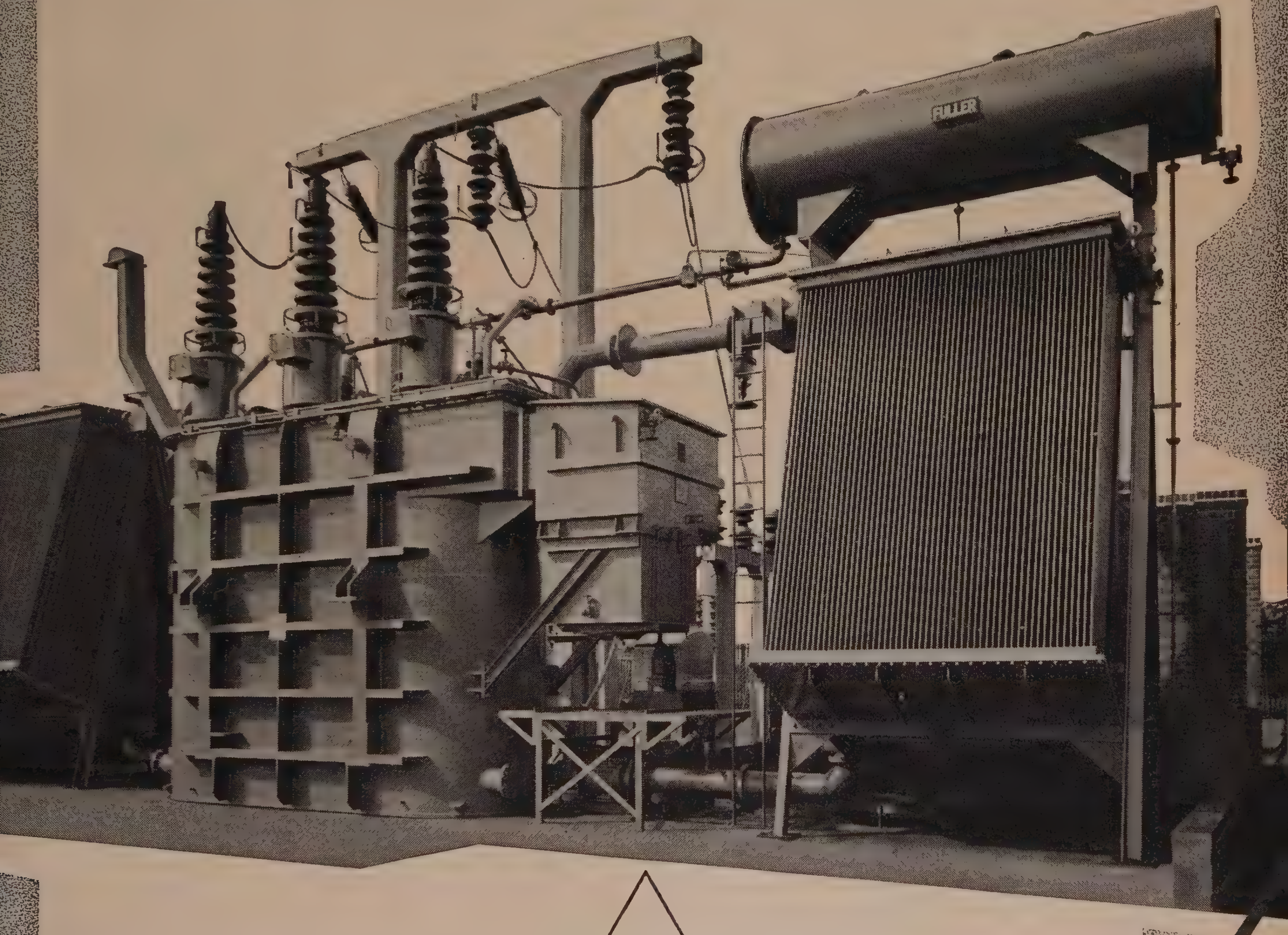

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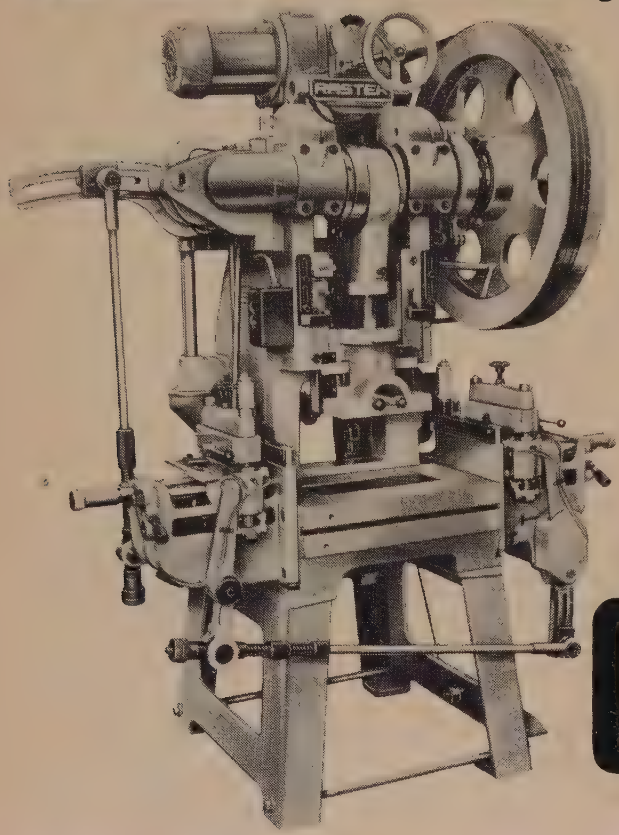

with precision strip feed and supplementary actions from front, rear and below.

In various capacities 20–80 tons

Micrometer adjustment of gripper feed giving accuracy down to ·0005″ according to feeding length.

Infinitely variable stroke speeds.

Fine adjustment of stroke.

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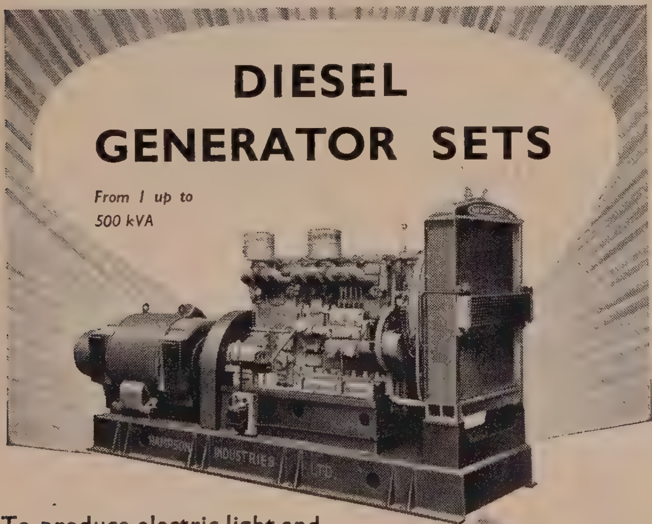
DIESEL GENERATOR SETS

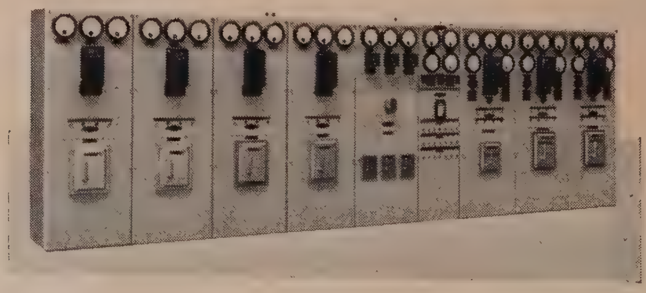
From 1 up to 500 kVA



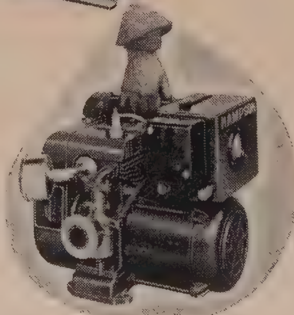
SPECIAL SWITCHBOARDS AND ELECTRONIC CONTROL PANELS

Below is shown a multi-control and feeder panel with push button circuit breaker control and metering equipment for a 1000 kVA substation. It incorporates electronic timers for process timing of a number of machines in a large factory engaged on automation.

★ *Hampson will design and make any control panel to suit any requirements.*



To produce electric light and power for all purposes The World famous Hampson units can also be arranged for automatic starting in the event of a failure of the Public Mains supply, so that a continuous source of Electrical power is always available.



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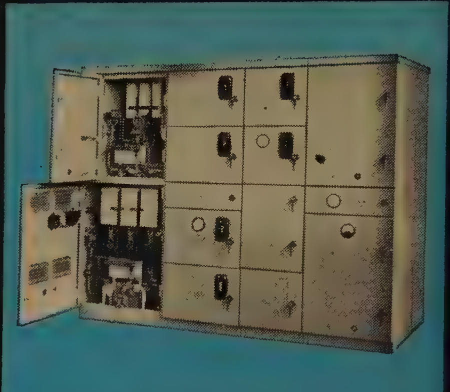
Extensible ring main, type KAA4 using two type DA4 oil switches



Switchboard with 800A and 1600A air circuit breakers in double tier formation

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. . . night and day, year in, year out—always ready for action. G.E.C. Switchgear has been proved by the most stringent tests at the works. But that's not all. This inherent reliability has been proved, time and again, at hundreds of installations all over the world.

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30 MVA at 400/660V and up to 250 MVA at 3.3kV.

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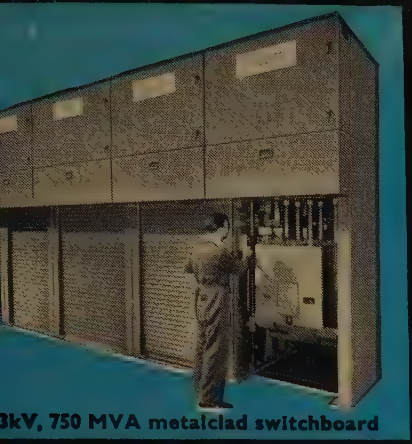
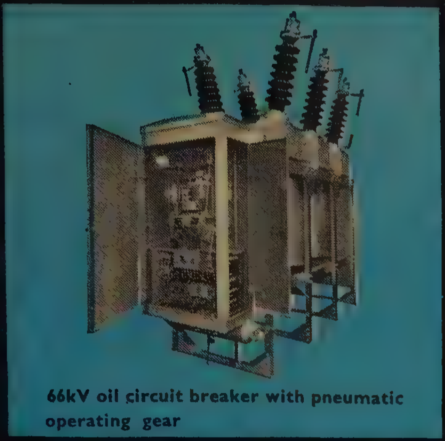
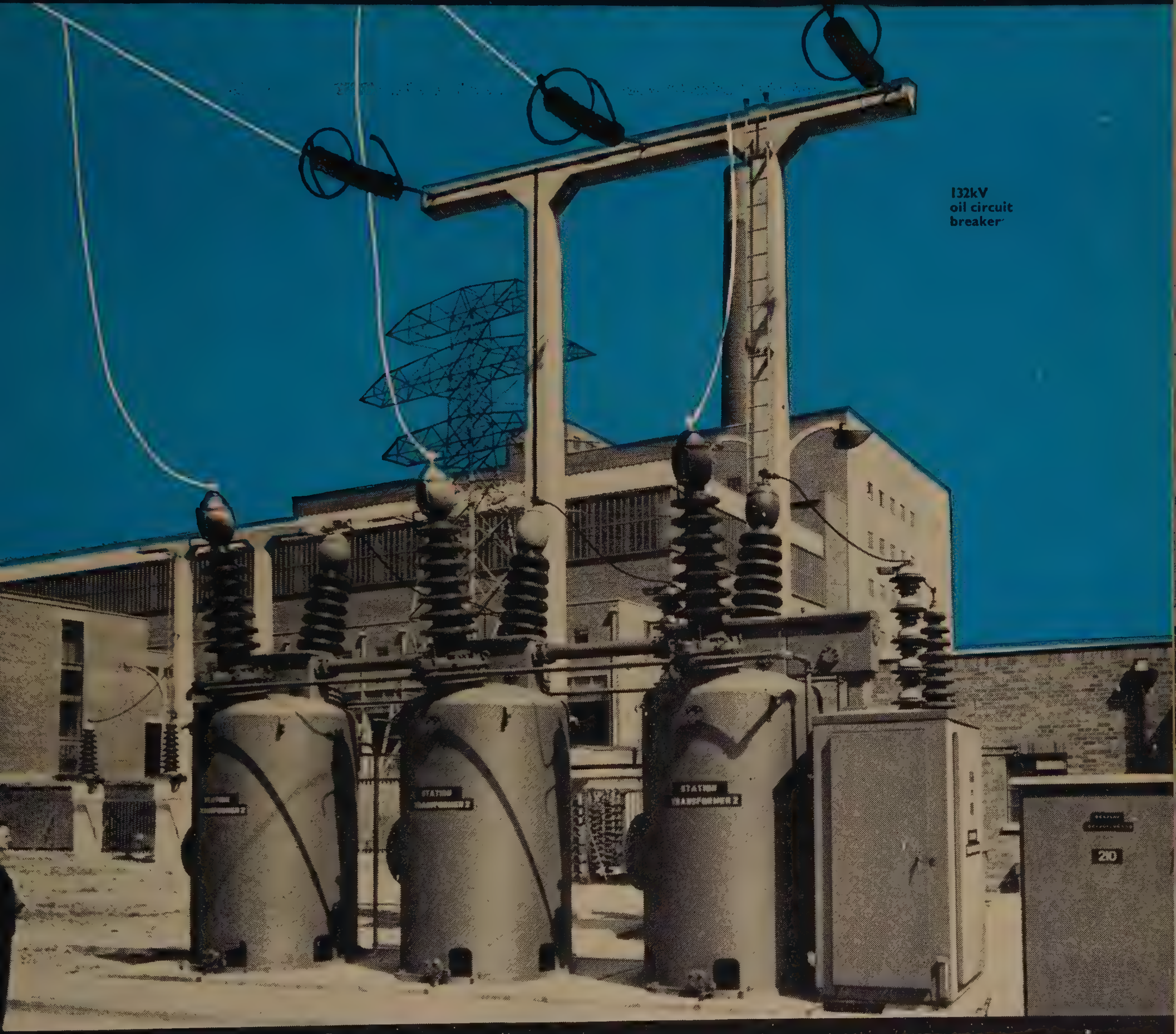
OUTDOOR OIL CIRCUIT BREAKERS
11kV to 132kV—up to 5000 MVA at 132kV. Breakers up to 750 MVA at 33kV available from stock.

You are invited to ask for the Technical Descriptions of the above switchgear

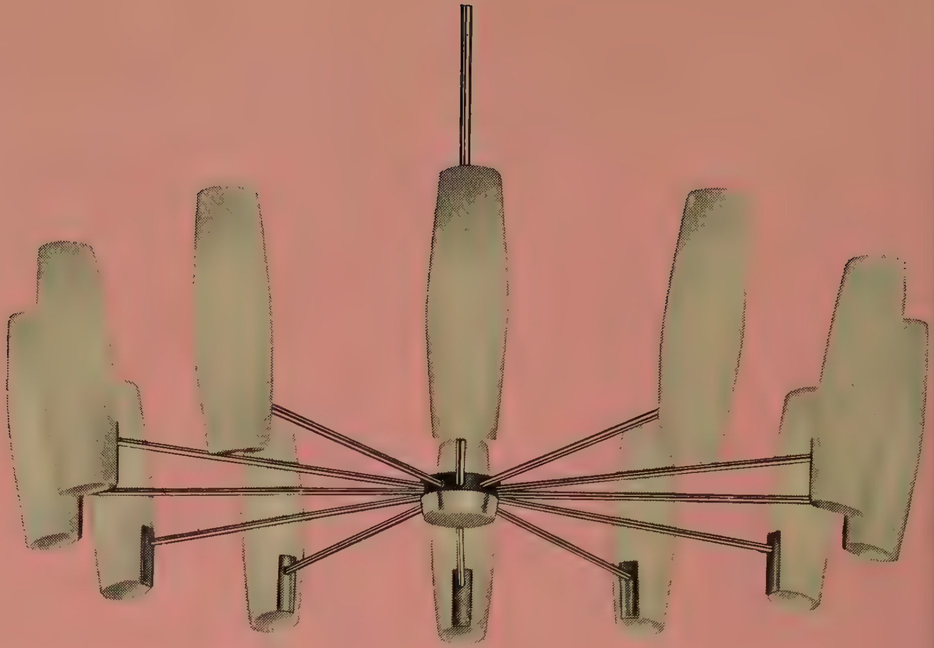

3kV, 750 MVA metalclad switchboard


66kV oil circuit breaker with pneumatic operating gear


132kV
oil circuit
breaker

G.E.C. power control equipment

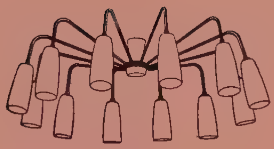
THE GENERAL ELECTRIC COMPANY LIMITED OF ENGLAND
HEAD OFFICE: MAGNET HOUSE KINGSWAY LONDON WC2

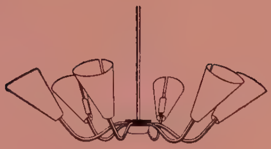


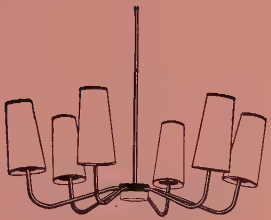
a new elegance in lighting

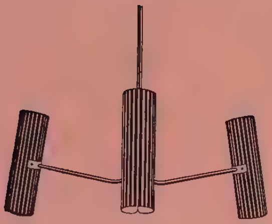
VARI FORM

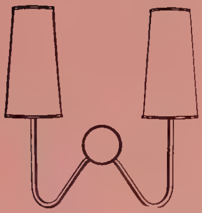
interchangeable unit fittings











Beautifully made from durable materials, the "Variform" interchangeable parts provide literally thousands of elegant and sophisticated lighting fittings.

Whether it be a small three or large twelve light pendant or ceiling fitting, colourful or restrained, with wall brackets to match, your choice of design is almost unlimited with "Variform". Illustrations and further details will gladly be sent on request.

Photograph by courtesy of 'The Queen'

G.E.C.

LIGHTING DIVISION

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

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ROZALEX BARRIER CREAMS protect

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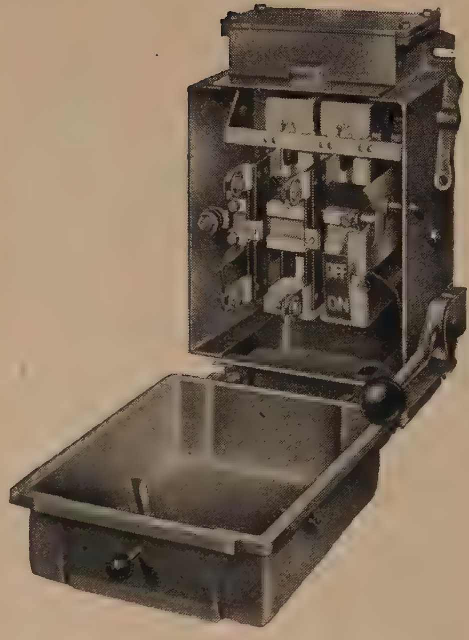

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ISOEARTH
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WM. SANDERS & CO. (WEDNESBURY) LTD.
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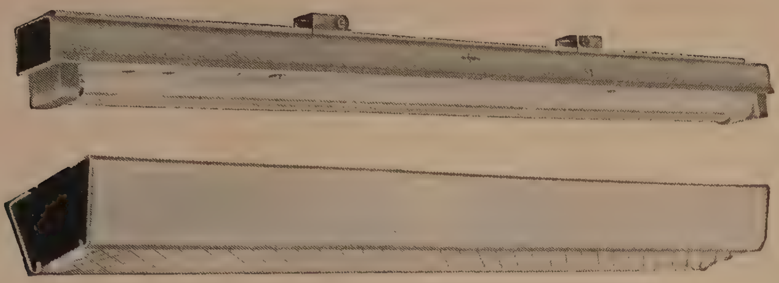
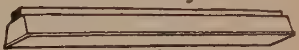
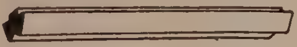
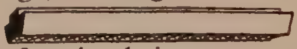


looking for light fittings that are real all-rounders?

The varying lighting needs of office, works or showrooms *need not now* involve any extra expense on different fittings,  special installations or complex maintenance. With only the one basic fitting of **atlas atlantic** you can achieve the right light for every department, by a simple interchange of standard units. Create an attractive, *integrated* lighting system through the whole premises, at the same time increase efficiency and lower costs.

 The flexibility of the **atlas atlantic** range extends even further. Alter the functions of floor space at any time, and you need change only reflectors and diffusers to fit the new lighting demands . . . from a robust, functional fitting for stockrooms, to a superb boardroom fitting with decorative diffuser.

The unique features of the chassis, the quality and appearance of the fittings, the high efficiency of the fluorescent light,  and the very wide range of units bring you a new concept of low-cost lighting.

atlas atlantic fittings are available in sizes 8ft., 5ft., and 4ft. with single or double tubes.

atlas atlantic

flexibility in fluorescent lighting

Atlas Lighting Limited, Thorn House, Upper St. Martin's Lane, London WC2

DTV. A289

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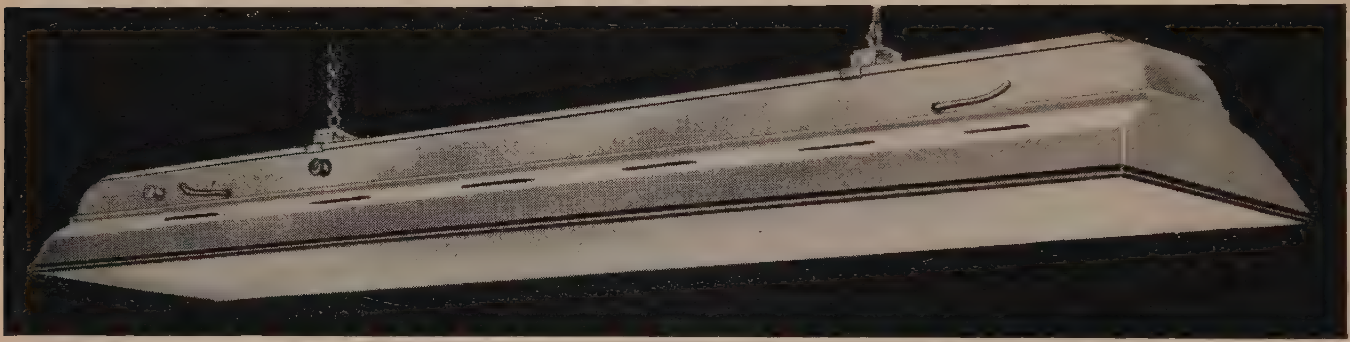

Why do most of the larger Companies specify Vitreous Enamel reflectors? Because they are more efficient, retain their reflective properties indefinitely, and are easier to clean since age discoloration does not occur. Thorlux Vitreous enamel reflectors are an investment wise buyers are finding well worth while—we will gladly give further details on request.

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Send for leaflet No. 292B for further details.

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(2) SHOULD MAINS FAIL THE LAMP WILL BE EXTINGUISHED AND THE BUZZER SOUND UNTIL THE SWITCH IS PLACED IN THE "OFF" POSITION
(3) WHEN THE MAINS ARE RESTORED THE LAMP WILL GLOW AND THE BUZZER SOUND UNTIL THE SWITCH IS RETURNED TO THE "ON" POSITION.
(4) TO TEST THE BATTERY WHEN THE MAINS ARE NORMAL, MOVE SWITCH TO "OFF" POSITION, WHEN BUZZER SHOULD SOUND.
OFF
ON
GENTS

WHERE WARNING IS VITAL!

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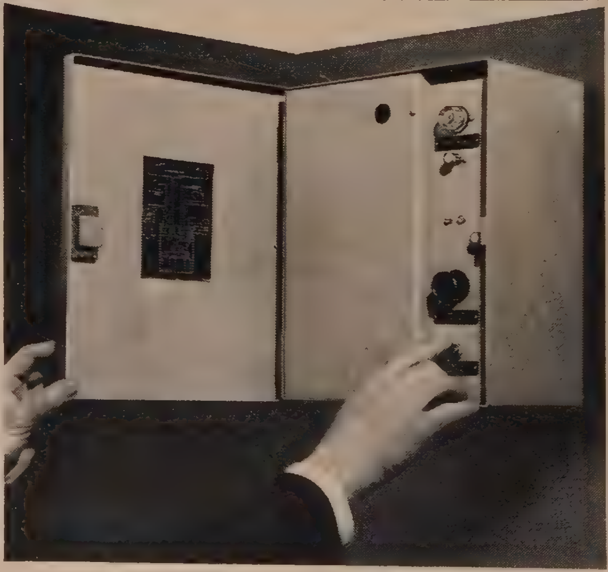
Send for leaflet No. 272F for further details.



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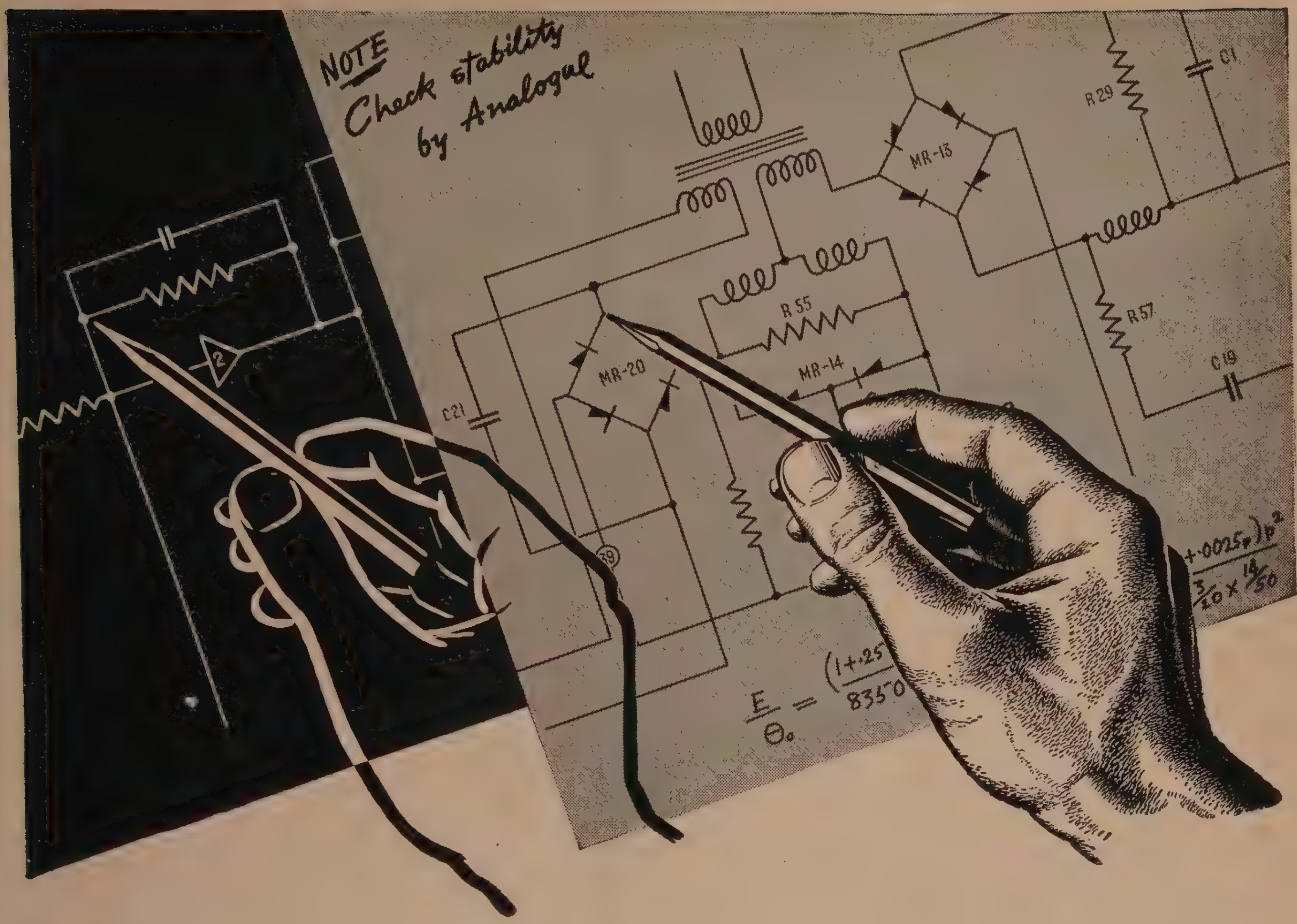
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Check stability by Analogue
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R29
C1
R55
MR-20
MR-14
R57
C19
C21
2
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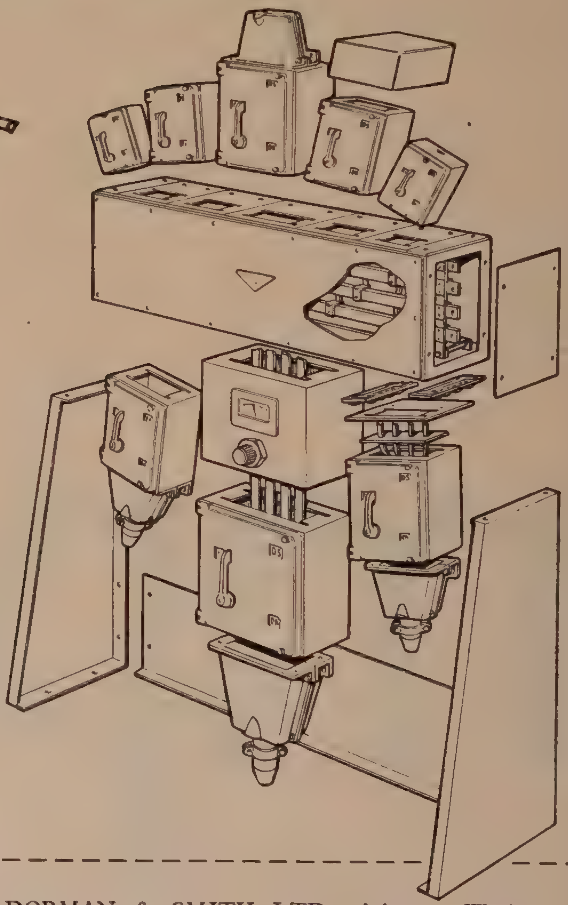

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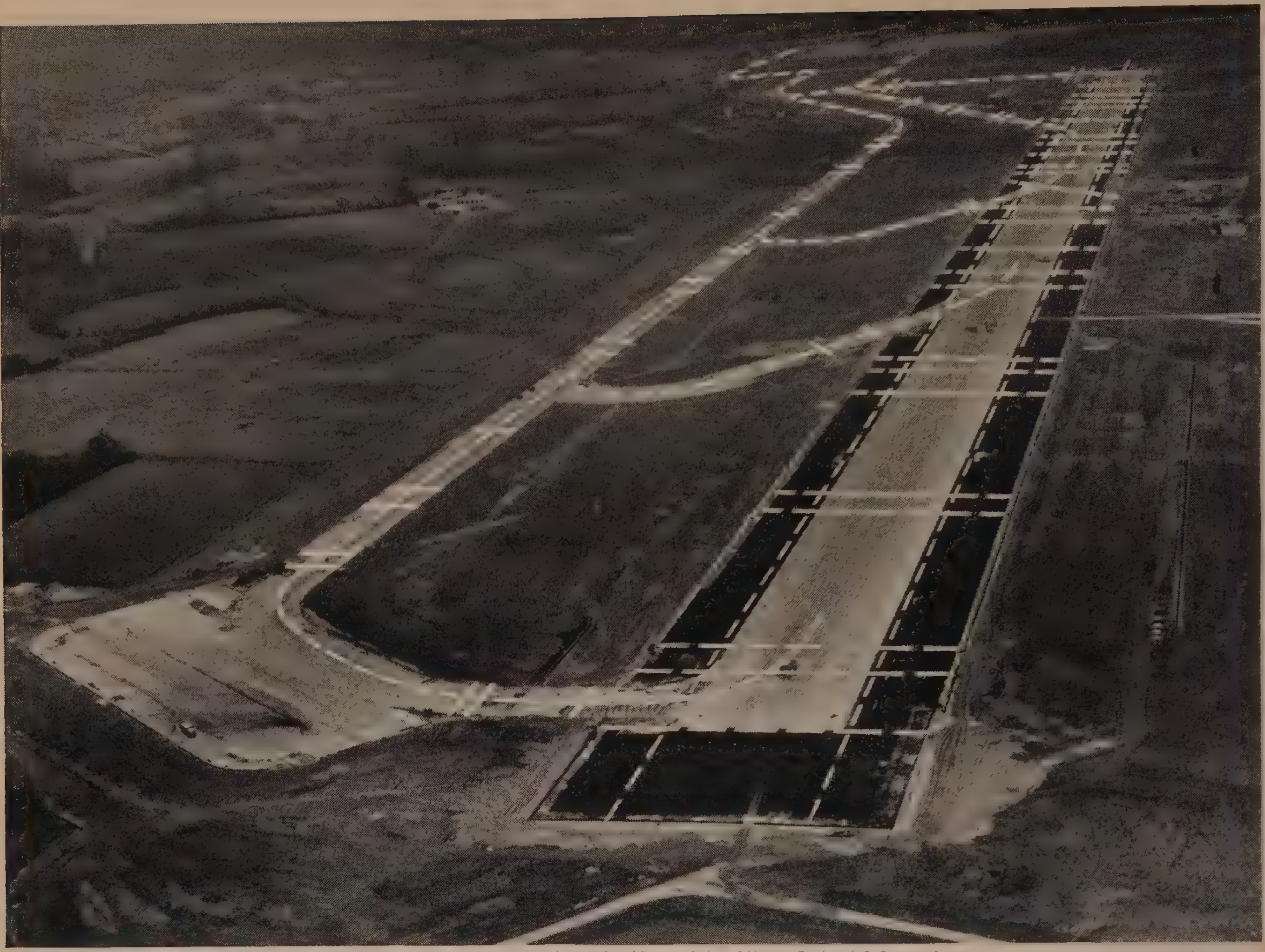

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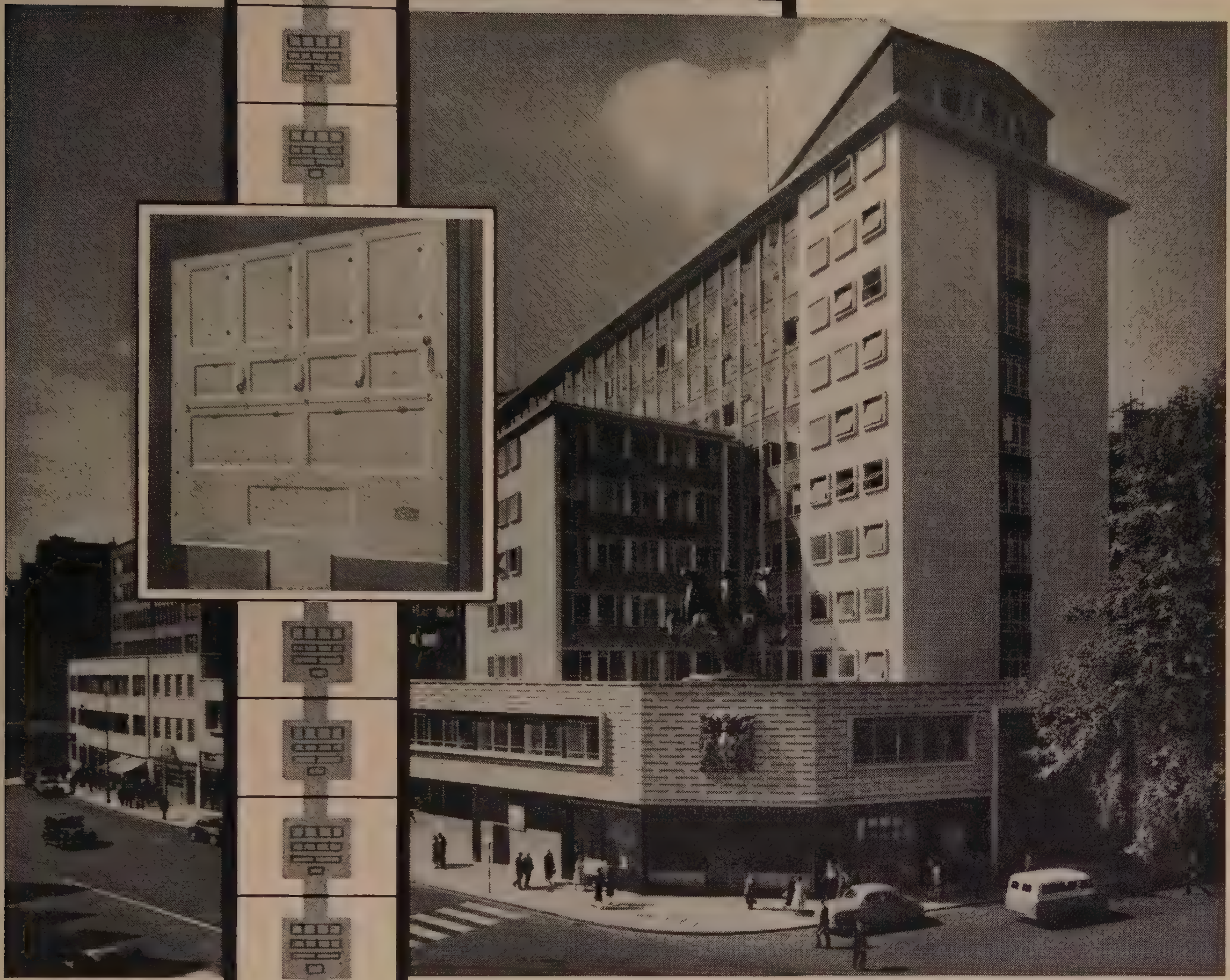

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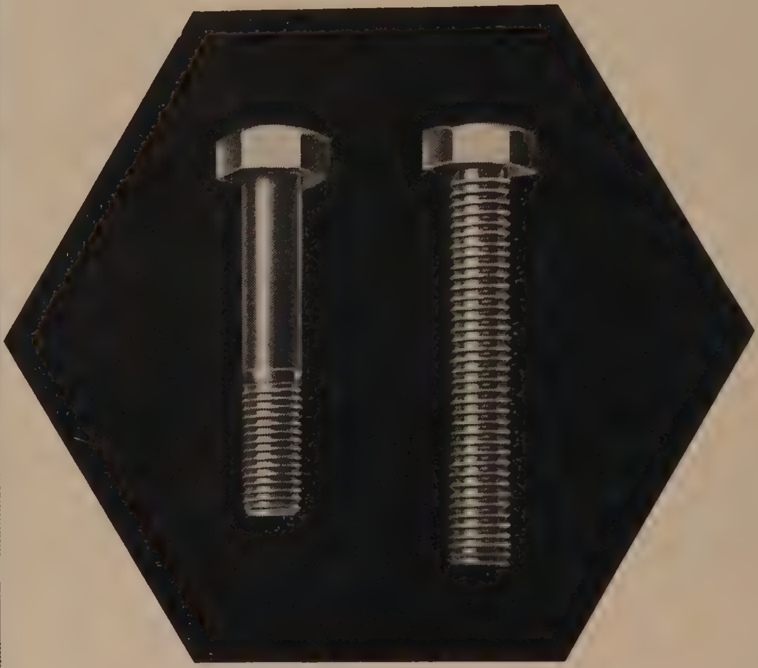

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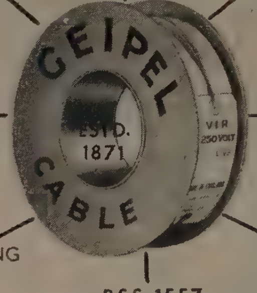

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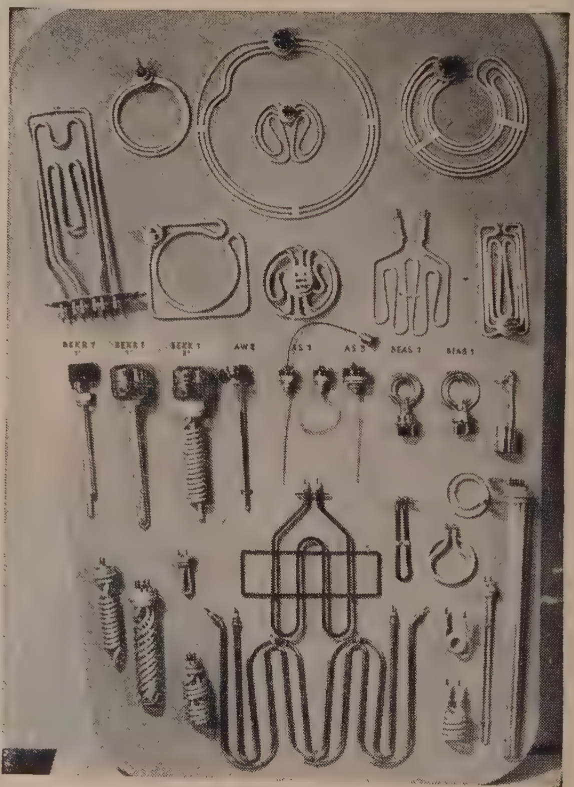

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BRAKE DESIGN

This picture shows a flange mounting drip-proof motor, fitted with the disc brake. However, any Newman motor (drip-proof or totally enclosed) from fhp—40 hp, foot, flange or face mounting can be equipped with the brake. See over for more details.

Newman

Making the pace in motor progress

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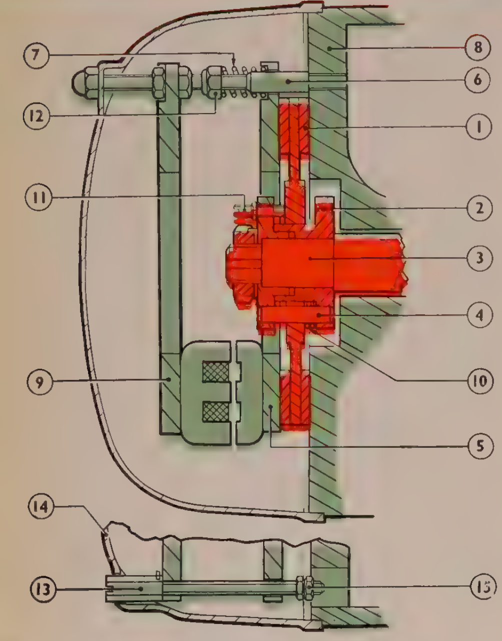
BRAKE DESIGN



🟥 *Rotating parts of brake* 🟩 *Stationary parts of brake*

his diagram shows a single disc brake mechanism. Double disc rakes are used for higher torque values but construction is similar.

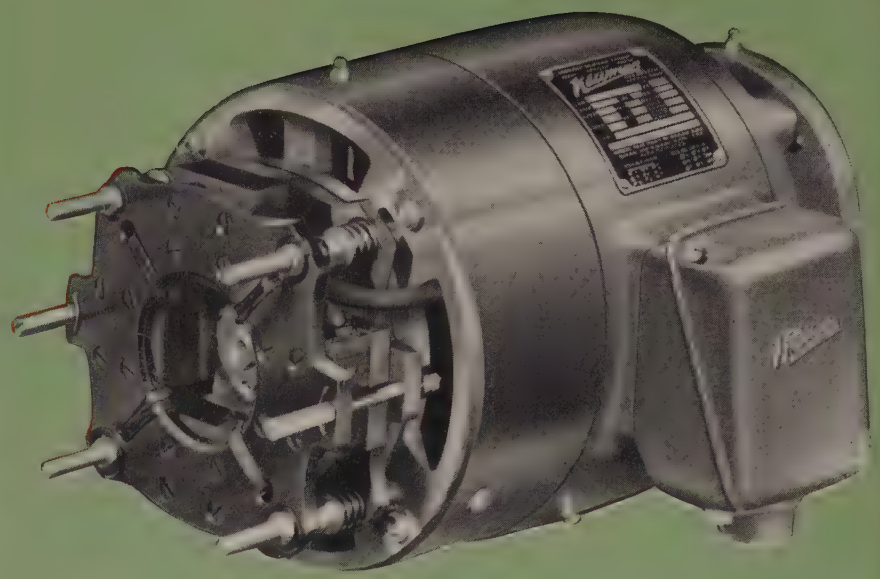
CONSTRUCTION AND OPERATION

he cast iron brake disc with brake linings bonded to both sides of it l) is mounted on a steel hub (2) which is keyed to an extension of e motor shaft (3) at the non-drive end and secured endwise against a oulder on the shaft by a locknut and tab washer. Drive from the ub to the brake disc is by four steel pins (4) retained between the ub flanges and on which the disc is free to move endwise. One side f the armature (5) has four laminated cores attached to it, the ther side being used as one of the stationary braking surfaces. The rmature is free to move endwise on the guide pins (6) and the springs) clamp the disc between the armature and the non-drive end racket (8) of the motor which is suitably machined as the other ationary braking surface. The magnet (9) is a cast iron plate arrying four special cores and windings and is secured endwise on e guide pins by locknuts.

Vhen the magnet is energised the armature (5) moves against the ressure of springs (7) to close the gap between it and the magnet, us removing the pressure on the brake disc. Four springs (10) ove the disc along the hub until it comes to rest against two tscrews (11) which are adjusted to centralise the disc between the ationary braking surfaces. There is then a clearance (normally 10″–·012″) on both sides of the brake disc and the motor is free to run.

he retarding torque of a particular brake can be adjusted (within mits) by altering the clamping pressure due to springs (7) by screwing ack the locknuts (12).

wo manual release screws (13) which project through the brake over (14) are provided for releasing the brake mechanically. These crews are threaded in the magnet plate but pass through clearance oles in the armature plate. Thus, when these screws are turned everal times anti-clockwise the locknuts (15) eventually pull the rmature plate back releasing the pressure on the brake disc. The osition of the locknuts (15) relative to the armature can be adjusted give quick release by only a turn or so of the screws and hand heels can be fitted to the release screws when frequent use of this cility is required.



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Newman were the first British company to introduce a complete range of brake motors from fractional up to 40 h.p. incorporating a disc type electro-magnetic brake as an integral part of the motor design. The motors themselves may be drip-proof or totally enclosed and are standard in every respect apart from special non-drive end brackets on which the brakes are mounted and the extension of shafts to carry the brake disc hubs. It is the brake mechanism which provides the most interesting story. Operating on the disc principle and being "built-in" to the motor the brake has low inertia and is amazingly compact, powerful and efficient. The brake incorporates a new electro-magnet design, is operated from the normal A.C. supply and is of the "fail to safety" type. Some idea of the unique design of the brake and its compactness is given below.

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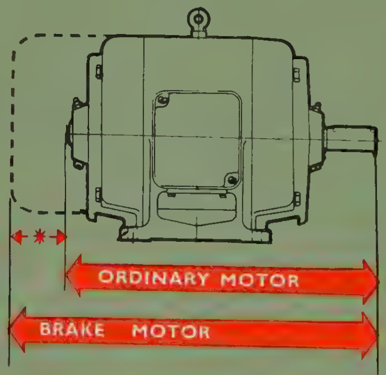

COMPACTNESS

An indication of the power for size ratio o Newman brake motors is given by this sca drawing—a 3 h.p., 4 pole brake motor wit maximum retarding torque of 14½ lbs. ft. i only 3¼″ longer than an ordinary motor of the same rating. In no case does the bra project beyond the present diameter of the motor.

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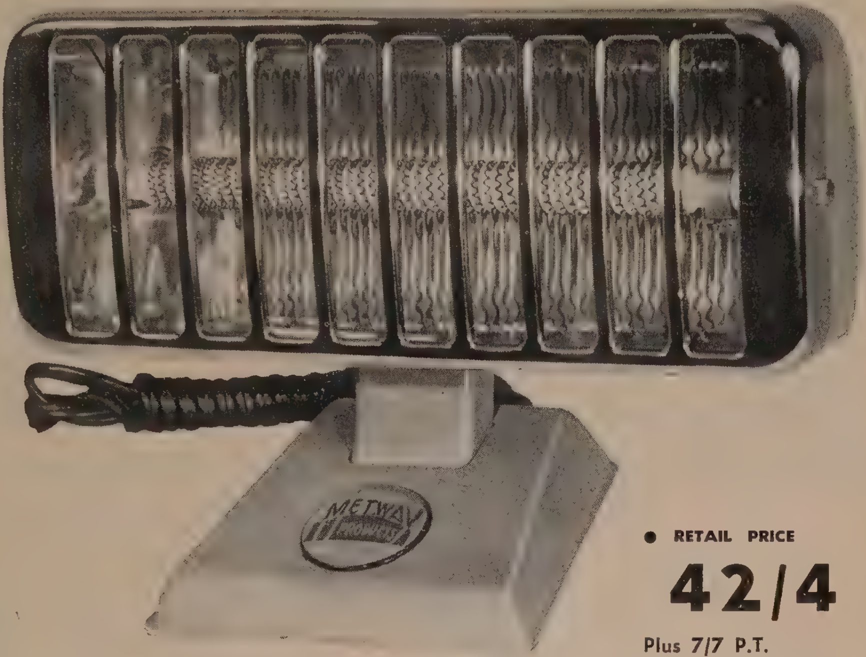

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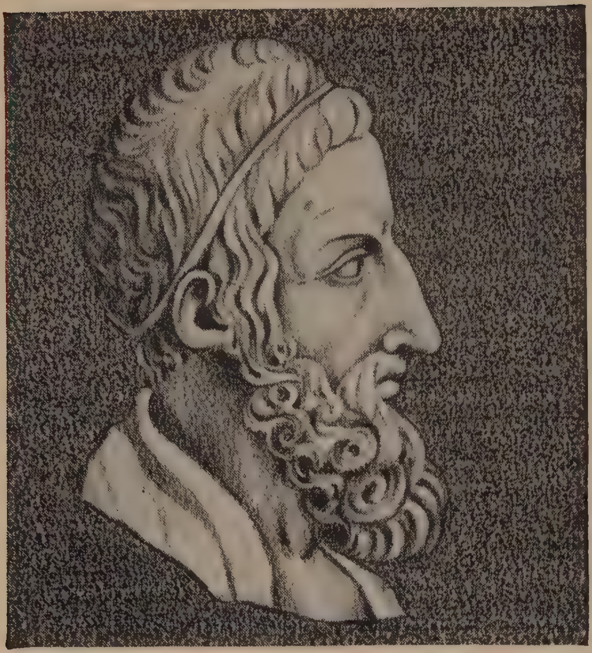

ARCHIMEDES 287—212 B.C.
Inventor of the Archimedian Screw

Pioneers...

One of the earliest recorded applications of the screw is the device invented by Archimedes (287–212 B.C.) for raising water; but nothing resembling the modern screw can be recognised before the sixteenth century when a book dated 1588 illustrates a wood screw forming part of a bellows. Machine-made screws appeared about 1760, but in spite of many improvements in manufacturing, their quality was poor and their use was limited. Then in 1846 Thomas Sloan of New York patented a machine which could successfully produce pointed screws. Sloan's initiative was to be decisive in making the wood screw an indispensable means of fastening.

This transition from limited to everyday use is also evident in the development of ceiling switches. These were originally tumbler switches modified for operation by two cords; but in the early 'twenties the Crabtree Company introduced the first single-cord ceiling switch in this country and thus initiated what is now regarded as an indispensable wiring accessory.

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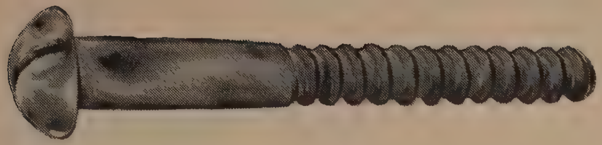
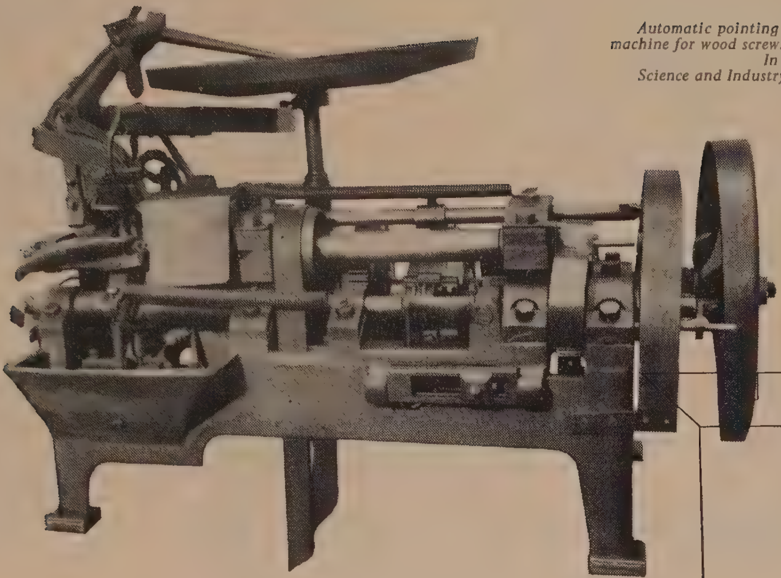
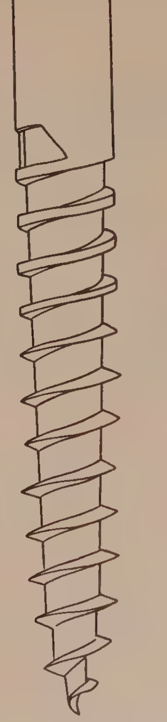


Old wood screw — pre 1846



Automatic pointing and threading machine for wood screws (about 1860) In the Museum of Science and Industry, Birmingham



Modern wood screw

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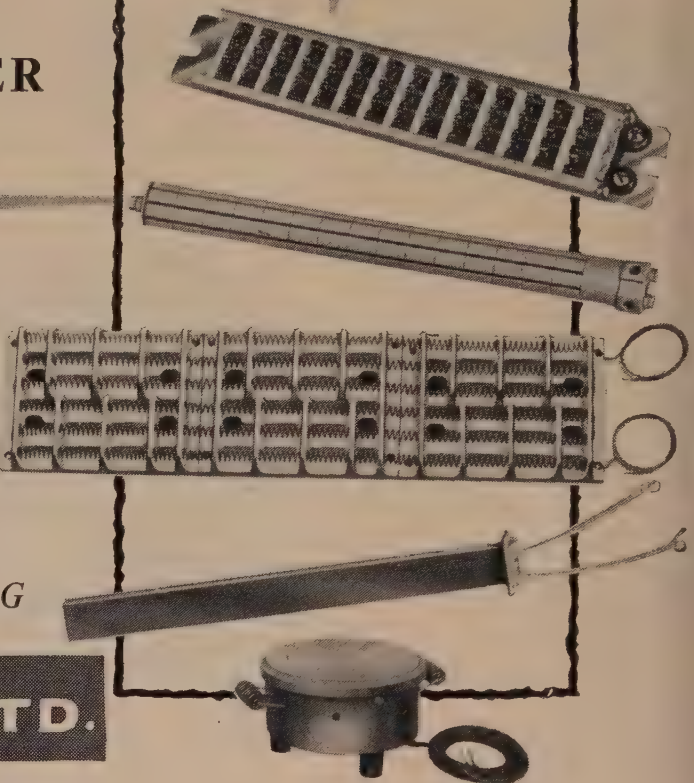

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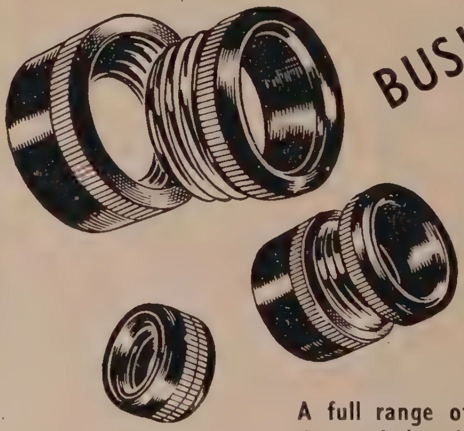

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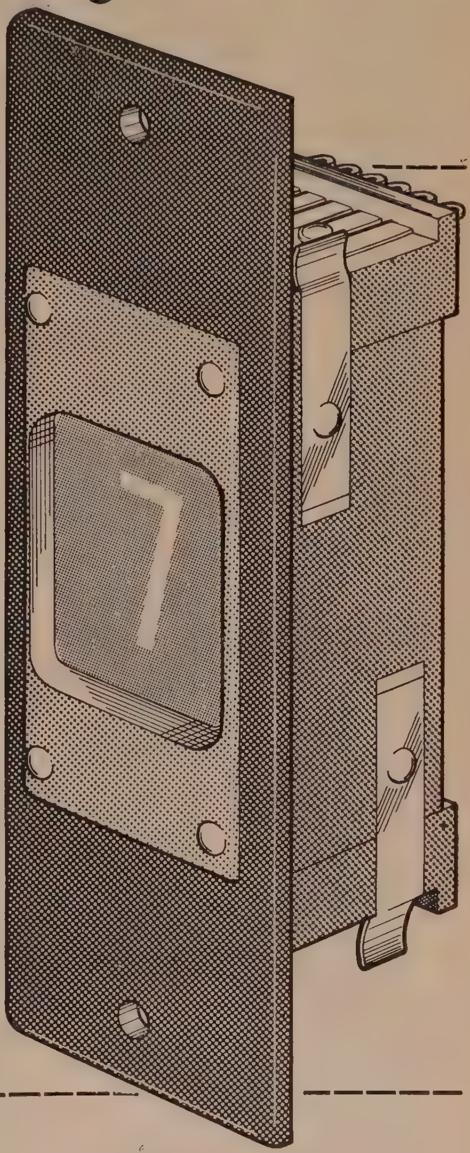
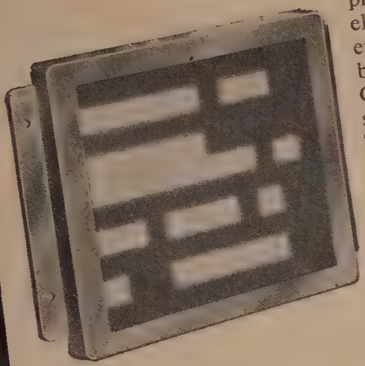
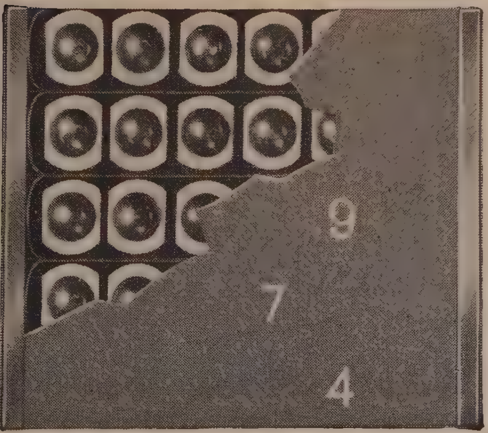


ELECTROLUMINESCENT INDICATOR BLOCK

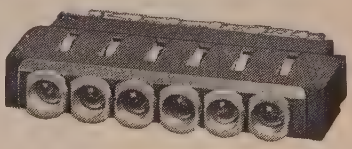


The device is a slim glass plate with an array of 100 electroluminescent spots energised from a printed circuit bonded to the rear face. Characters can be built up by suitable combinations of connections. The current consumed by each illuminated spot is a fraction of a milli-amp, the voltage required being of the order of 300 volts with a frequency range of up to 400 c.p.s. It is available as a separate component or as part of a complete read-out system. Overall dimensions:—3.500" x 3.000" x .265".



MULTIPLE LAMPHOLDER

When mounted in banks, the Thorn Multiple Lampholder (below) provides a clear legible read-out through variation in the pattern of illuminated Midget Panel Lamps. The bank of Lampholders can be overlayed with a sheet of "Plasteck" on which the desired characters are engraved—each character lining up with one filament. The cut-away illustration (left) shows the read-out system provided by this arrangement. Overall dimensions:—0.430" x 2.475" x 1.250" inc. terminals.



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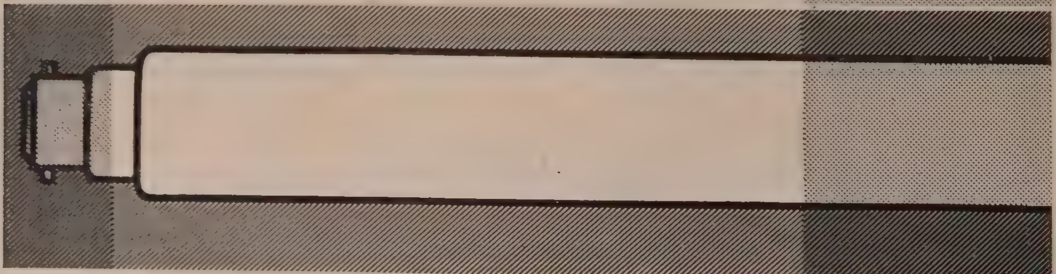

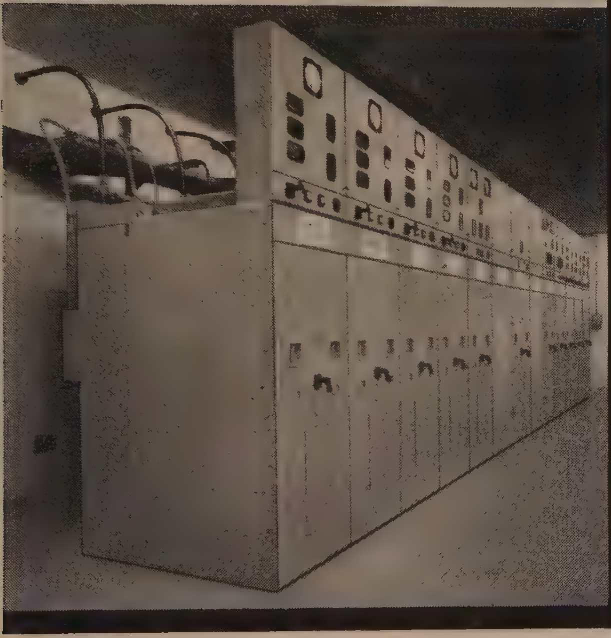

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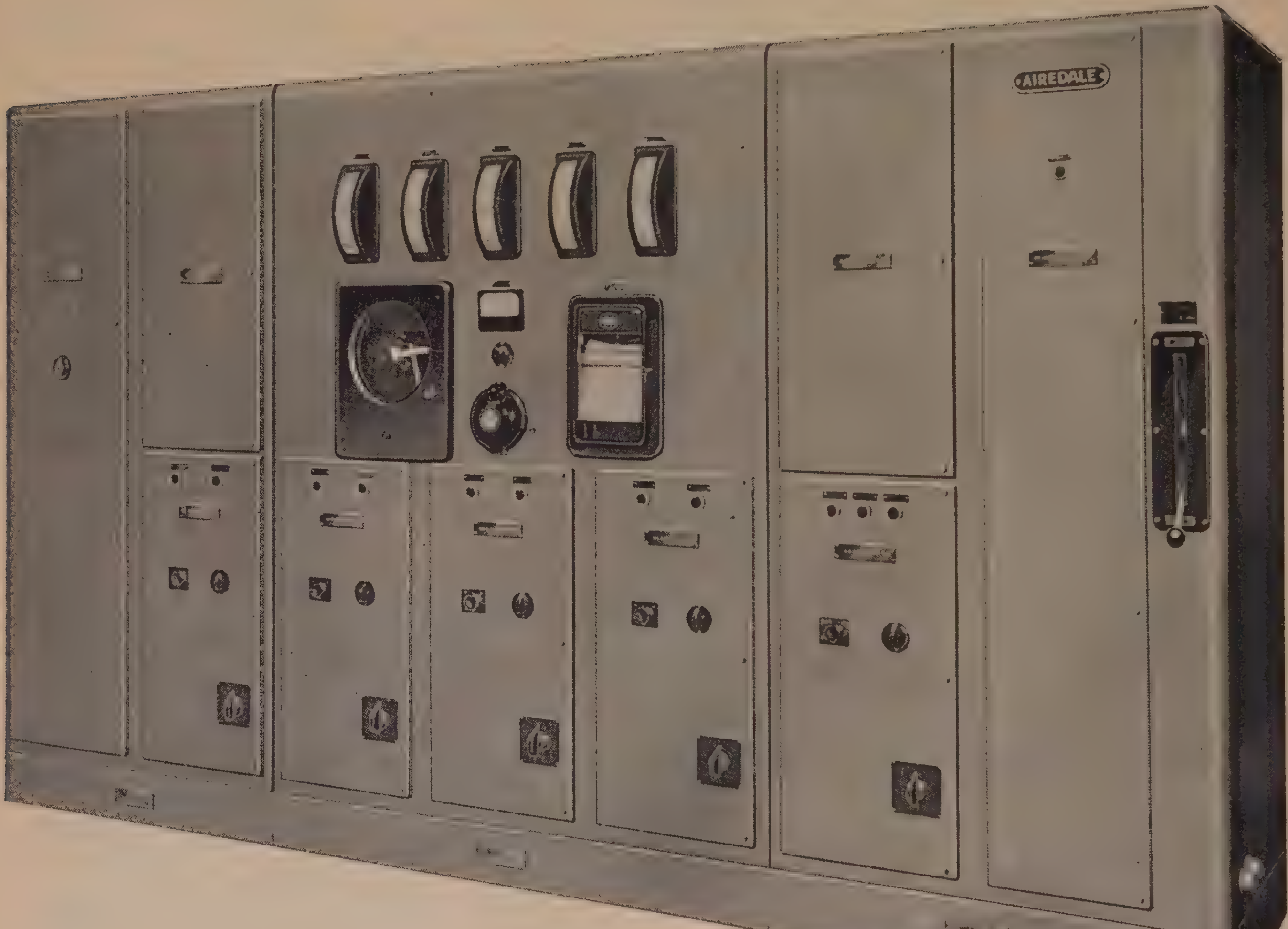

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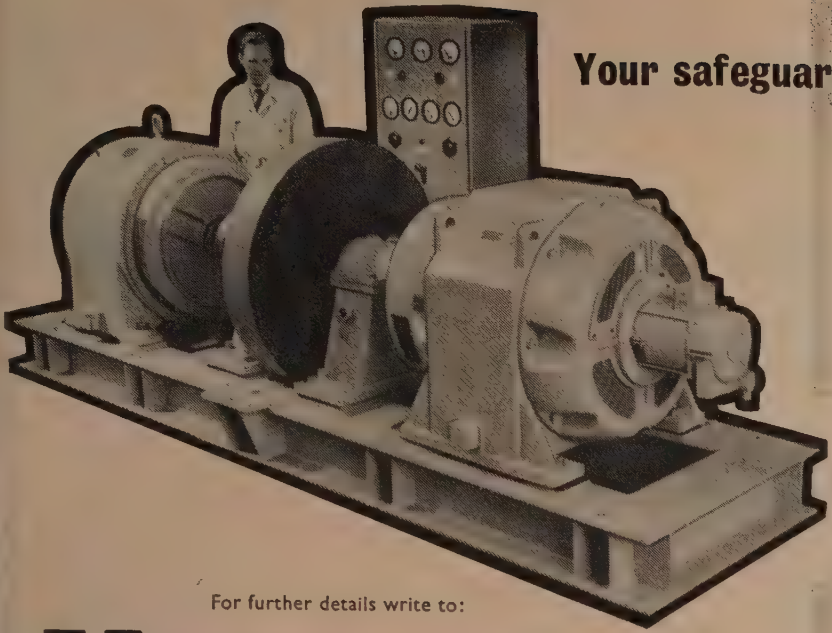

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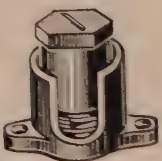

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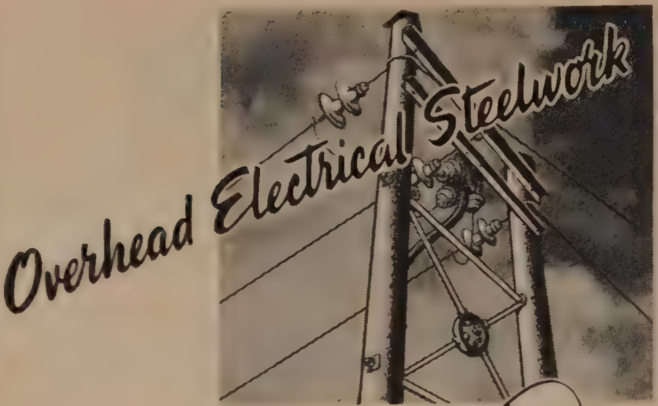

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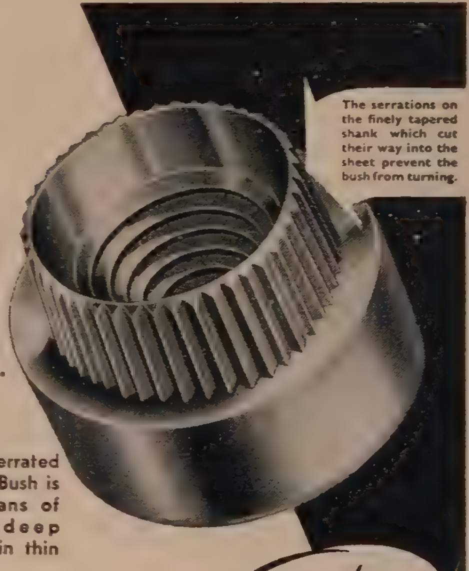

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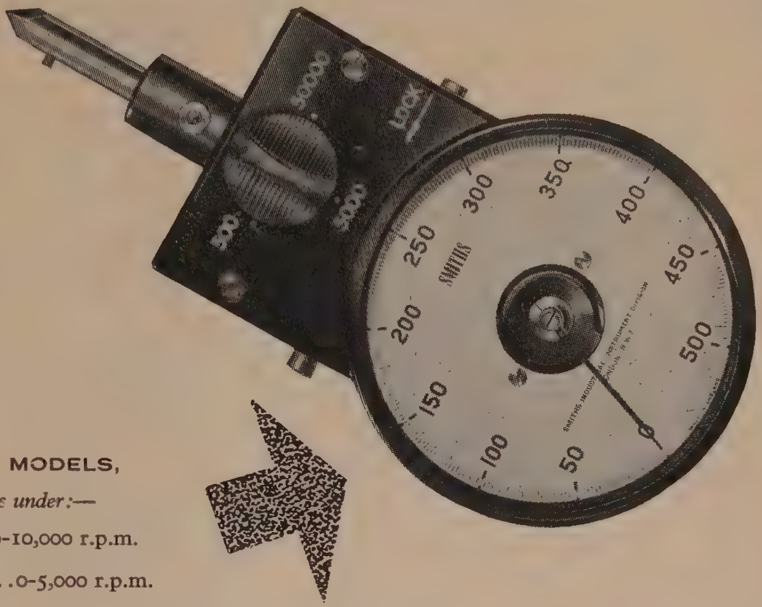

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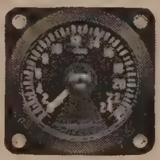

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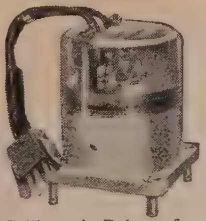

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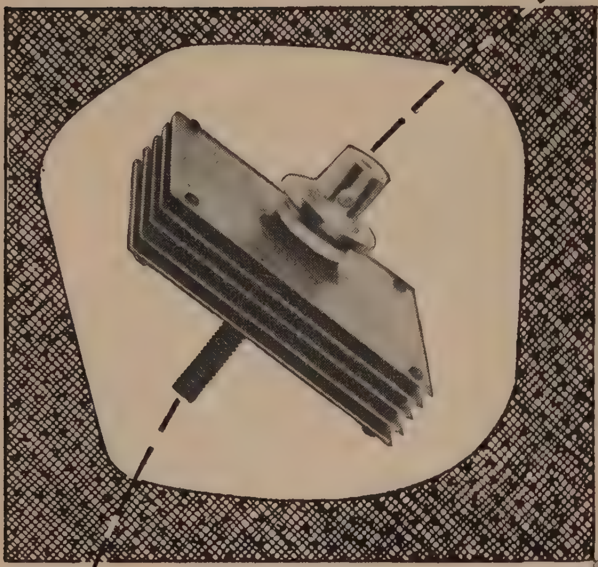

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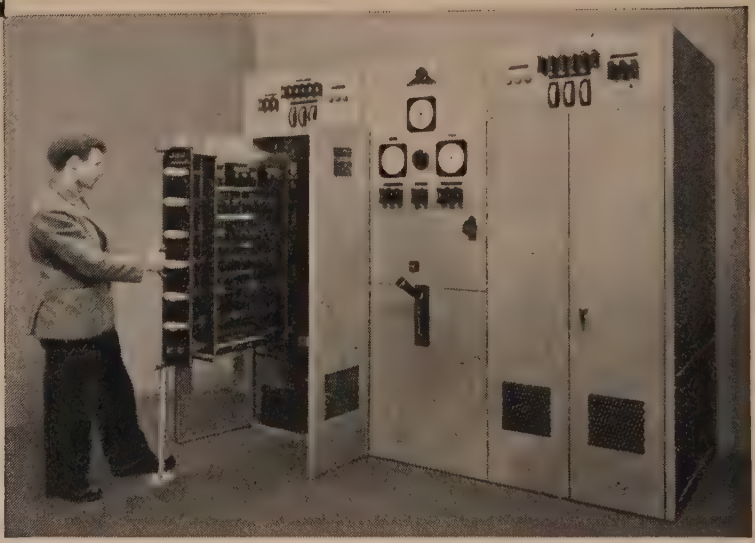
HEWITTIC GERMANIUM RECTIFIERS

EMPLOYING HEWITTIC DIODES



Greater efficiency — much greater at low voltages — plus reliability are features of Hewittic germanium rectifiers — designed and produced throughout against a rectifier engineering background of over 50 years. The illustrations show a Hewittic air cooled germanium diode and a 400 kW 230-0-230 volt D.C. (3 wire) Hewittic germanium rectifier for general workshop supply at the Crewe Locomotive Works, British Railways, London Midland Region. Silicon equipments can also be supplied.

Send for Publication R.193.

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- **Reversible spark tips give double life**
- **Reversible moving contact assemblies. Only two set screws to be removed**
- **Shock absorbers cushion the action of contacts when operated out of oil tank**
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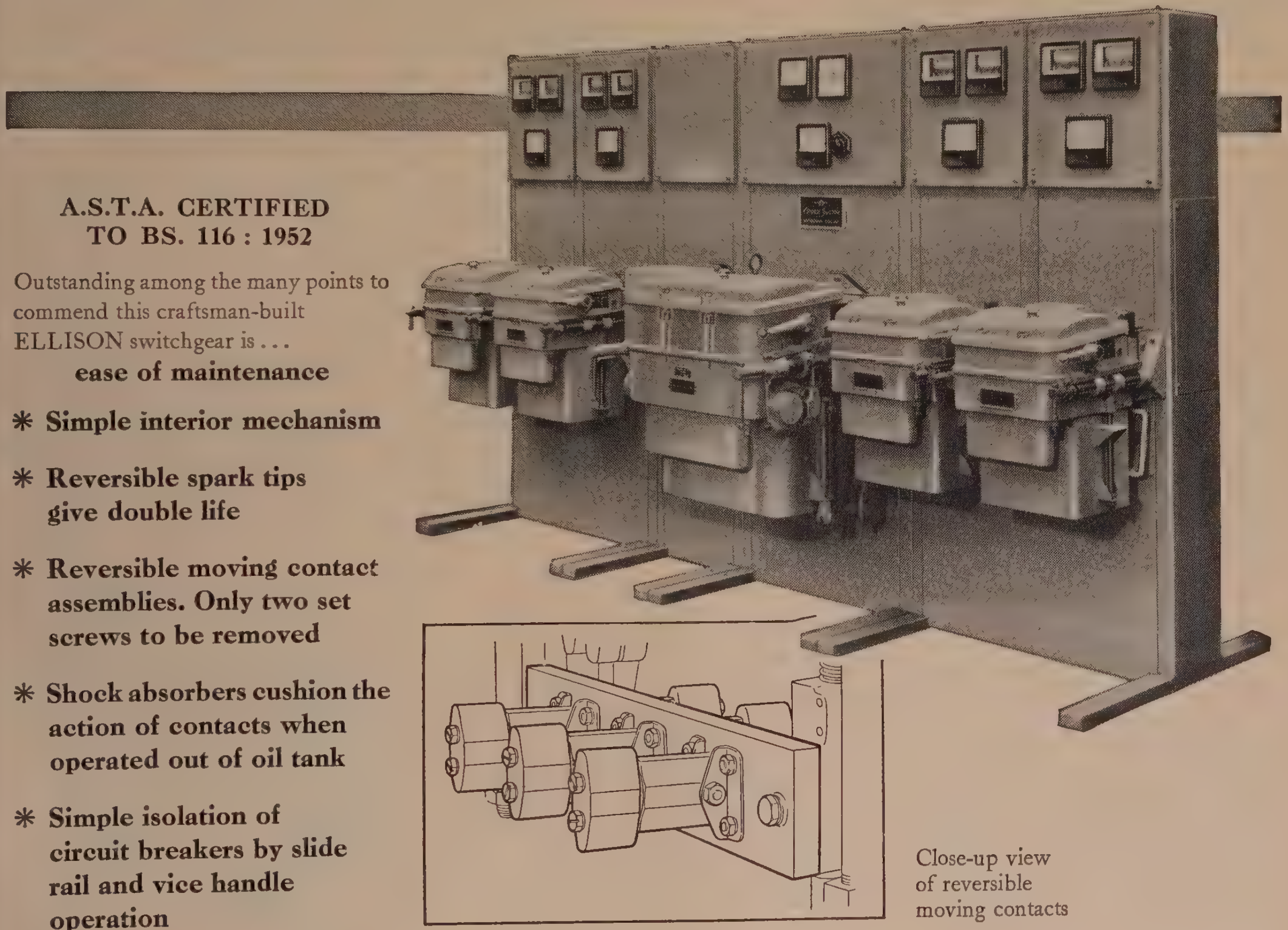

Close-up view
of reversible
moving contacts

For further information please ask for Leaflet C.L. 244

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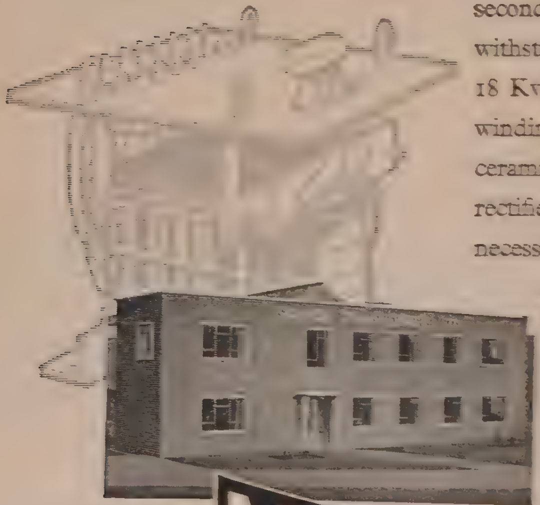
Continuing a Tradition

774

You can buy integrity

Integrity in people is properly regarded as an intangible something that money cannot buy. Yet Savage integrity is built into every Massicore transformer. It is as much an essential part of them as the winding or the core; unlike these however it cannot be included in a specification, constructed from drawings or supplied by the stores. Integrity manifests itself only in a piece of equipment which has been made by craftsmen, when individual attention has been paid to every detail, when in fact, amongst transformers, it is a Savage Massicore.

Illustrated is a high voltage rectifier filament transformer. The 4v 12A secondary winding is insulated to withstand a working voltage of 18 Kv DC and the leads from this winding are taken direct to the ceramic valveholder holding the rectifier valve. This obviates unnecessarily long high potential leads.



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SAVAGE TRANSFORMERS LIMITED
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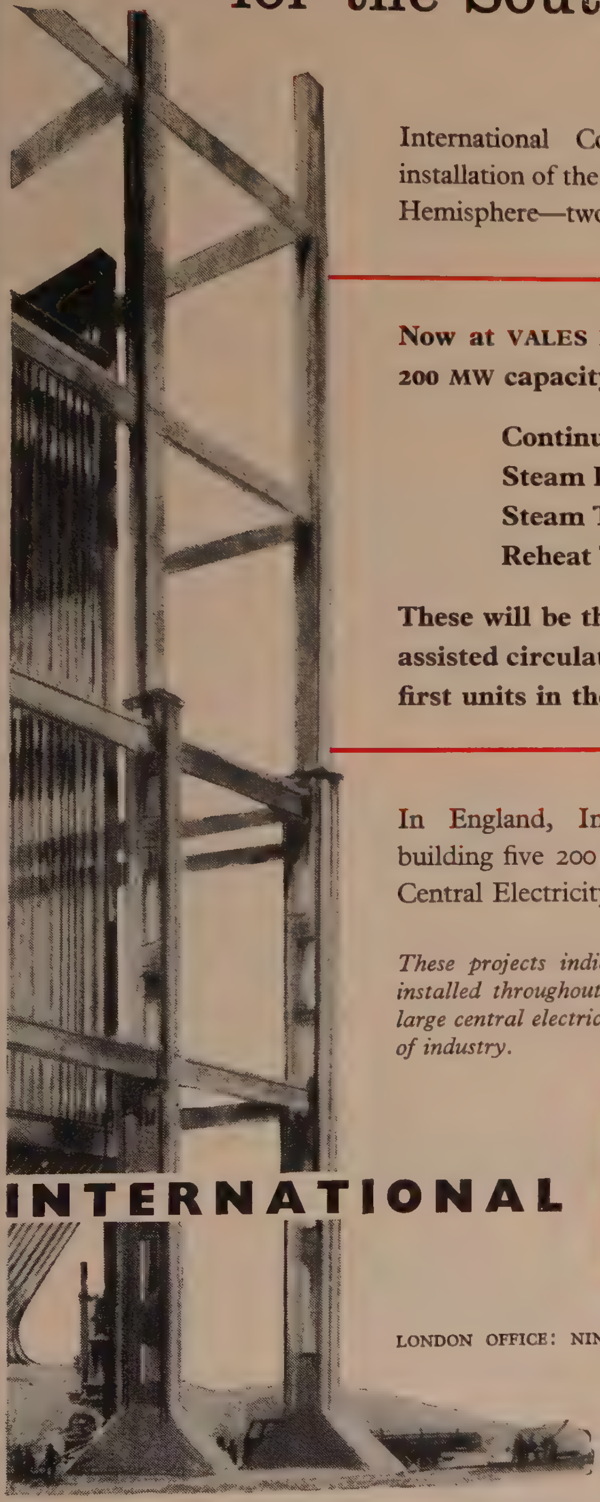
SAVAGE MASSICORE

The International Combustion Organisation secures the contract for the LARGEST STEAM GENERATING UNITS for the Southern Hemisphere



International Combustion were responsible for the installation of the first 100 MW boiler units in the Southern Hemisphere—two units at TALLAWARRA, Australia.

◀ 100MW

Now at VALES POINT, Australia, two IC boilers of 200 MW capacity are to be installed:—

Continuous maximum rating: 1,350,000 lb/hr
Steam Pressure: 2,450 lb/sq. in.
Steam Temperature: 1,055°F
Reheat Temperature: 1,005°F

These will be the first high capacity controlled and assisted circulation boiler units in Australia and the first units in the country to employ a reheat cycle.

◀ 200MW

In England, International Combustion Limited are building five 200 MW units and one 550 MW unit for the Central Electricity Generating Board.

◀ 550MW

These projects indicate the confidence placed in IC equipment installed throughout the world, meeting the requirements both of large central electricity generation and the specialised applications of industry.

IC

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TGA SG84

The Versatile MARTINDALE Blowers

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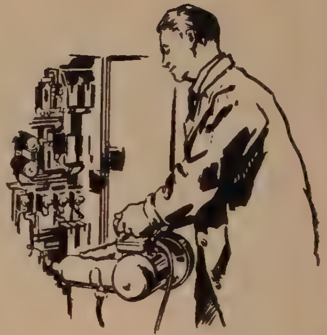
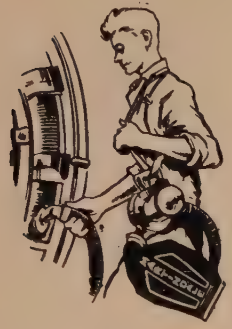
The powerful Martindale Blowers direct a stream of dust-removing air into every inaccessible crevice of electrical and other machinery, thus removing a common cause of short circuits and motor failures.

HOT AIR DRYING

The "Simoom" independent Heater is available for attachment to the Blowers and produces hot air for the quick drying of coils, transformers and for many other purposes.





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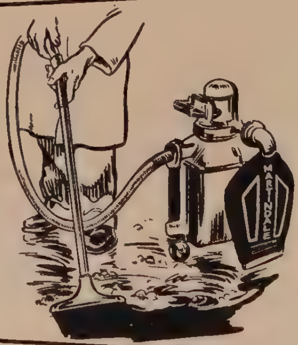
All of the five blowers are instantly converted into portable industrial suction cleaners by the use of standard attachments at little cost.

THE "PORT-A-VAC" (regd.)

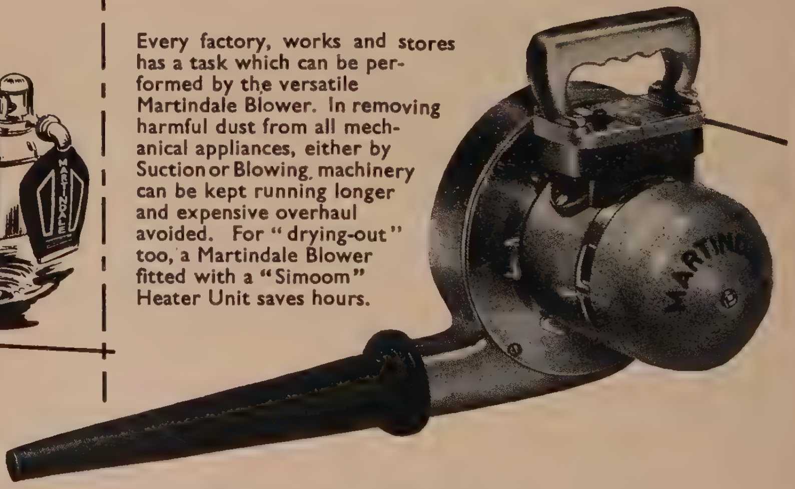
The "Port-A-Vac" (regd.) light-weight harness permits the Martindale Blower to be used as a powerful vacuum cleaner carried in comfort upon the operator's back leaving him free to climb ladders, etc., to clean out-of-reach parts of the factory.

"MARTINET" WET-DRY SUCTION PICK-UP

With this amazing equipment any Martindale Blower is converted into a suction cleaner which picks up both liquids and solids, the liquids and dirt being deposited into the special tank and only the airborne dust into the filter bag.



Every factory, works and stores has a task which can be performed by the versatile Martindale Blower. In removing harmful dust from all mechanical appliances, either by Suction or Blowing, machinery can be kept running longer and expensive overhaul avoided. For "drying-out" too, a Martindale Blower fitted with a "Simoom" Heater Unit saves hours.



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MARTINDALE BLOWERS

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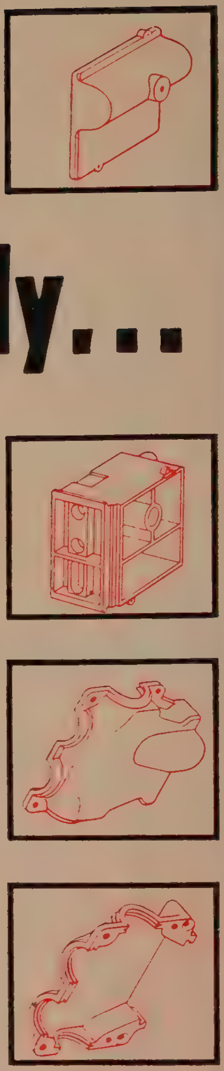

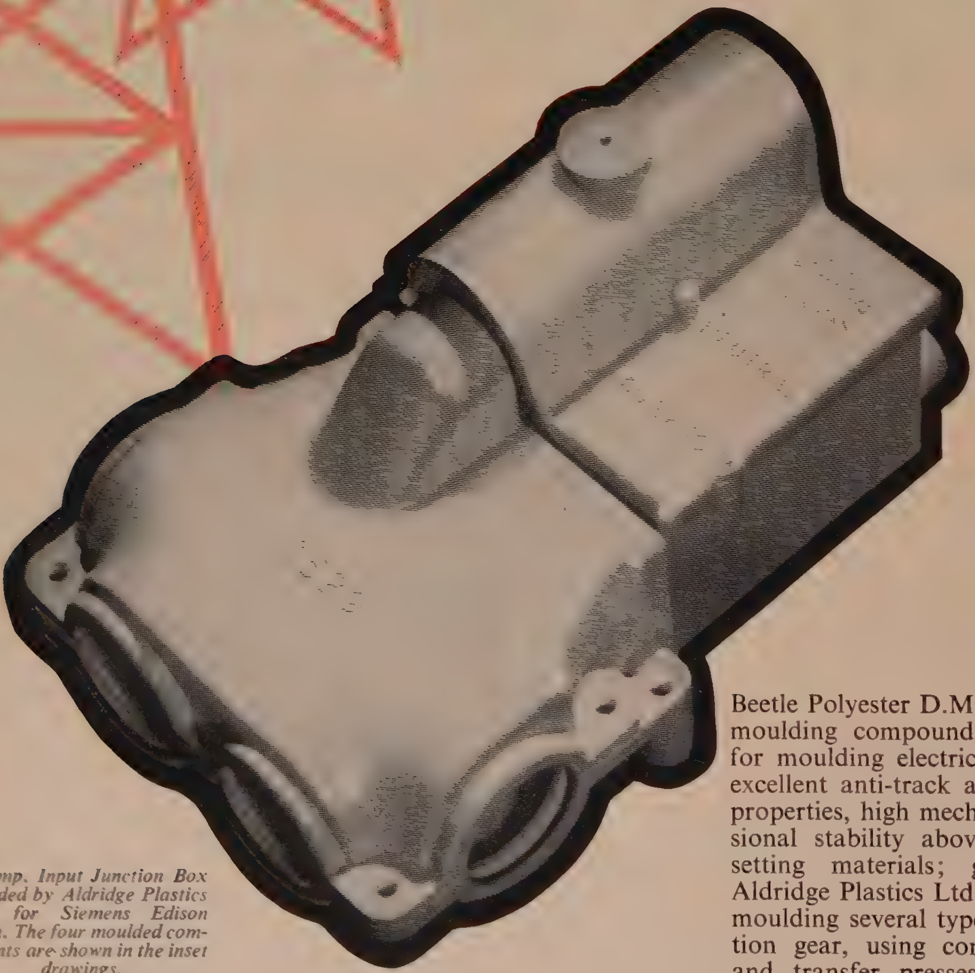

60 amp. Input Junction Box moulded by Aldridge Plastics Ltd. for Siemens Edison Swan. The four moulded components are shown in the inset drawings.

Beetle Polyester D.M.C., the new fast-curing moulding compound, is especially suitable for moulding electrical components. It has excellent anti-track and electrical insulation properties, high mechanical strength; dimensional stability above normal for thermosetting materials; good heat resistance. Aldridge Plastics Ltd. use Beetle D.M.C. for moulding several types of electrical distribution gear, using conventional compression and transfer presses. Write for technical leaflets.

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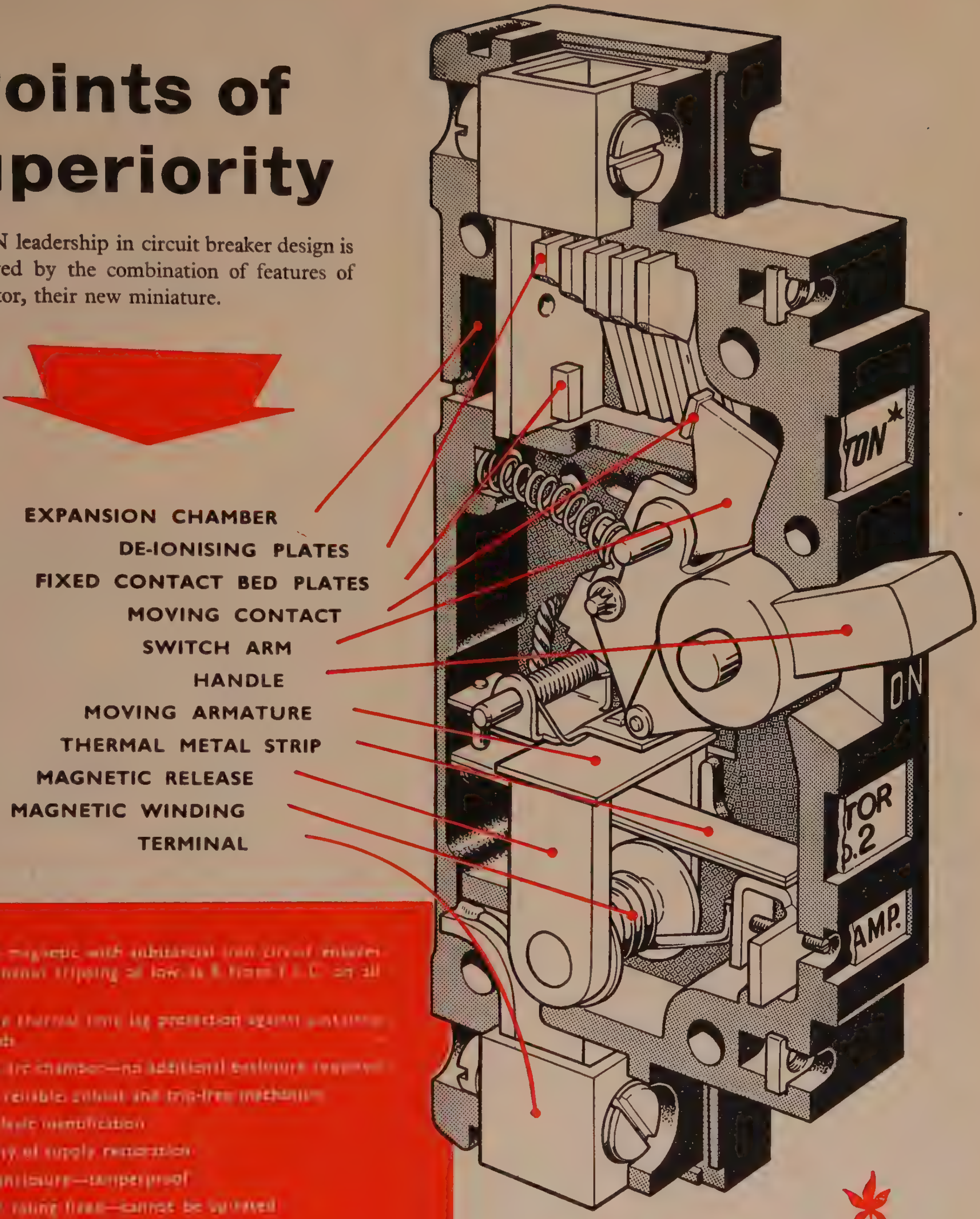

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general purpose **MINIATURE CIRCUIT BREAKER**

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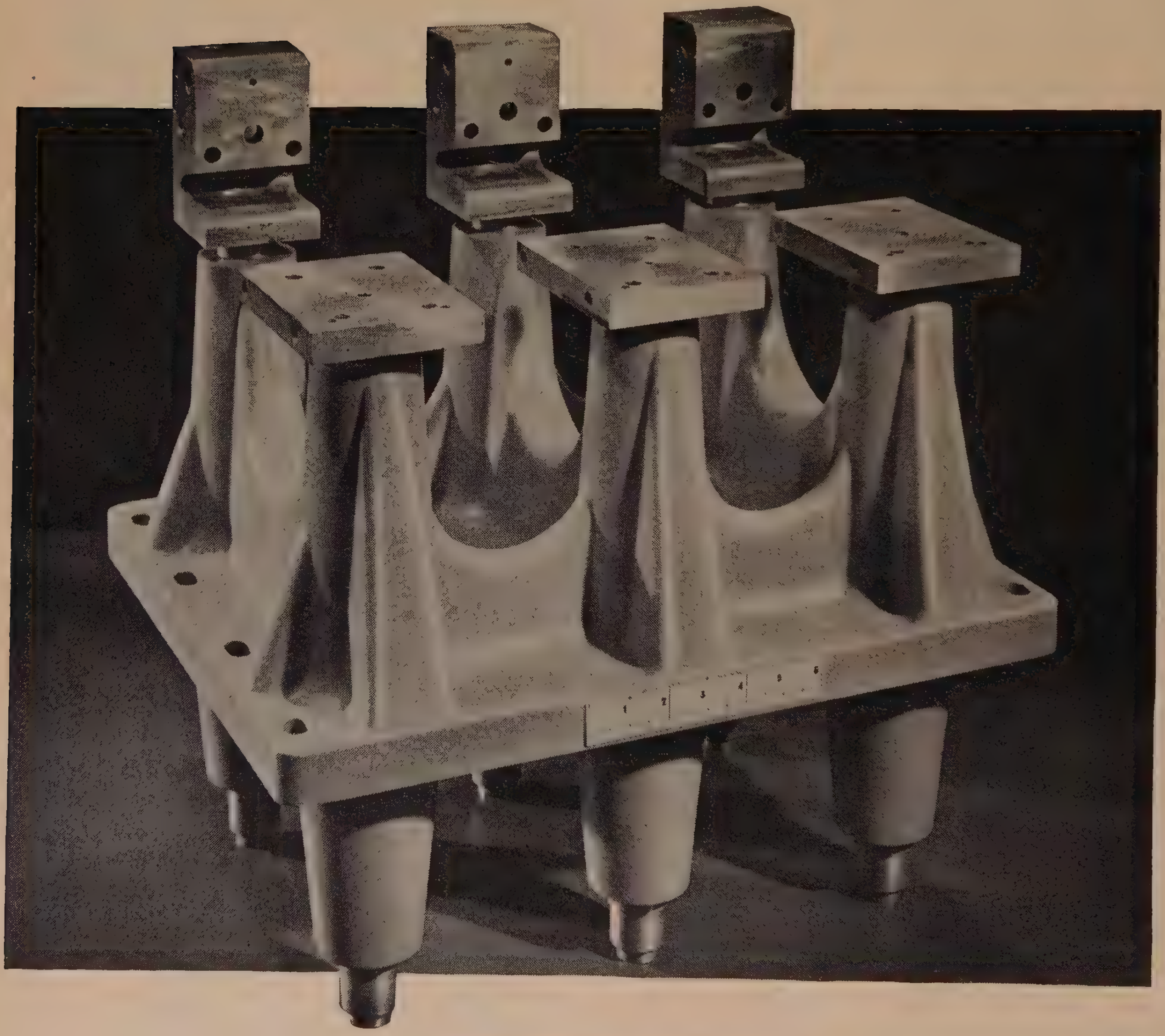
AP10

Designed to use Araldite

By designing components to take full advantage of the qualities of Araldite epoxy resins, manufacturers are effecting great economies in cost and are increasing the technical efficiency of their products. The photograph shows an air-break switch backplate, moulded in Araldite by J. R. Ferguson (Electrical Engineers) Ltd., for the Federal Pacific Electric Company of Newark, New Jersey, U.S.A. It replaces a built-up component comprising a cast aluminium base plate, bored to take six paper bushings, which were individually clamped in position. Into the paper bushings six copper assemblies were then keyed, involving a considerable amount of fitting. The single Araldite moulding assembly, weighing approximately 200 lb., accomplishes all the above operations. With careful moulding technique, machining and fitting are both eliminated, whilst the Araldite moulding ensures higher impulse levels.



Araldite *epoxy resins*

Araldite is a registered trade name

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AP 523

all this for a dozen oysters

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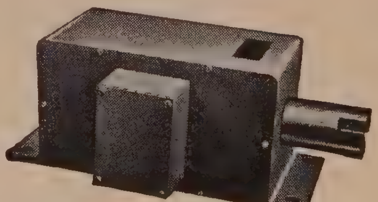

For full details of Varley Solenoids, write for Illustrated Catalogue S.2.

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For all its strength, corrugated fibreboard is exceedingly light in weight—and that means light in freight! Less bulky, too, than their wooden counterparts, these cases incur far less transport charges. Being non-returnable, they involve neither the supplier in the upkeep of records, nor the retailer in the expense of returned empties — no small matter when you're packing your toasters in Reed cases to points as far away as Fiji! Further, R.C.C's quantity production enables them to produce their cases at a highly competitive price.

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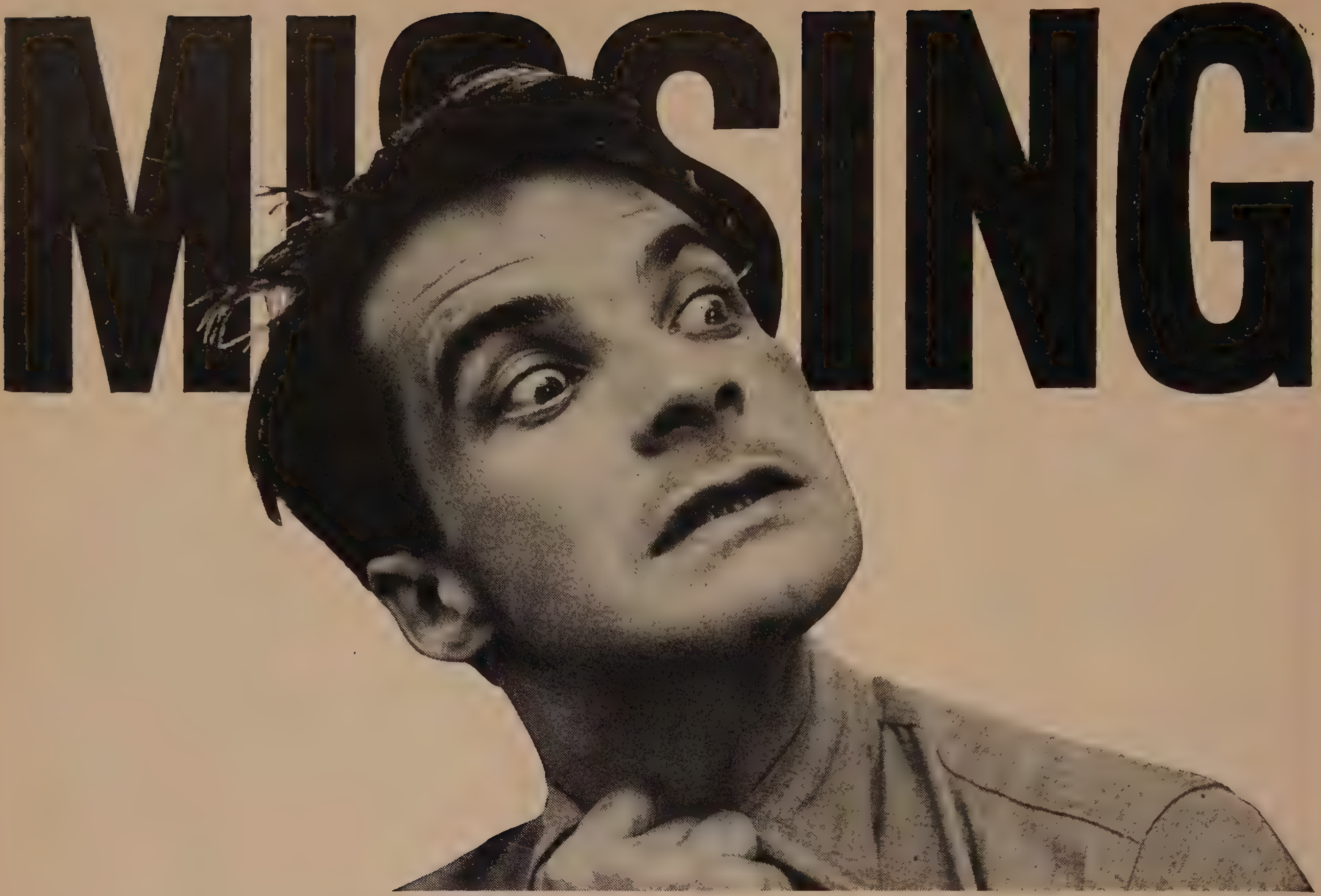

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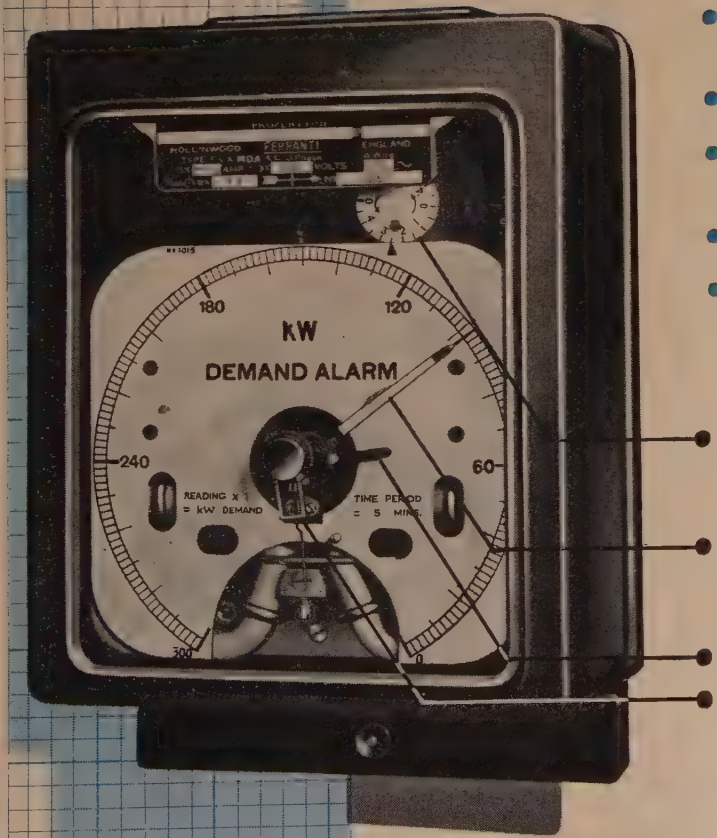

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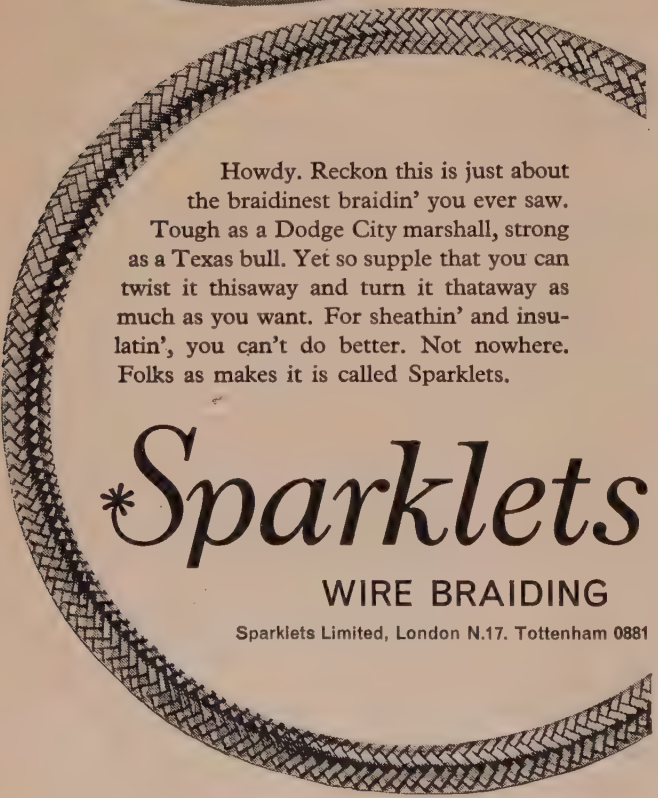

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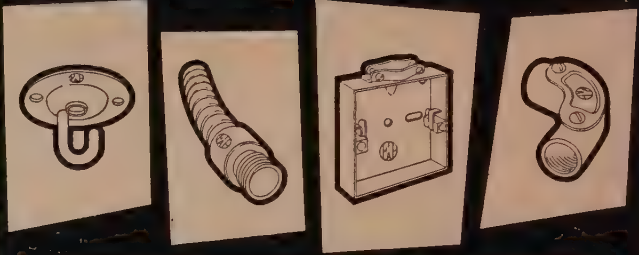

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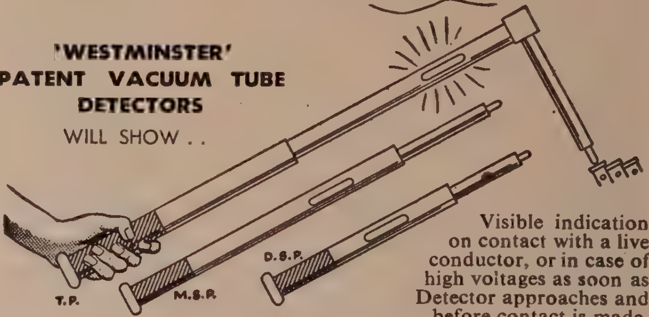

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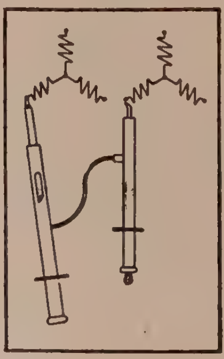

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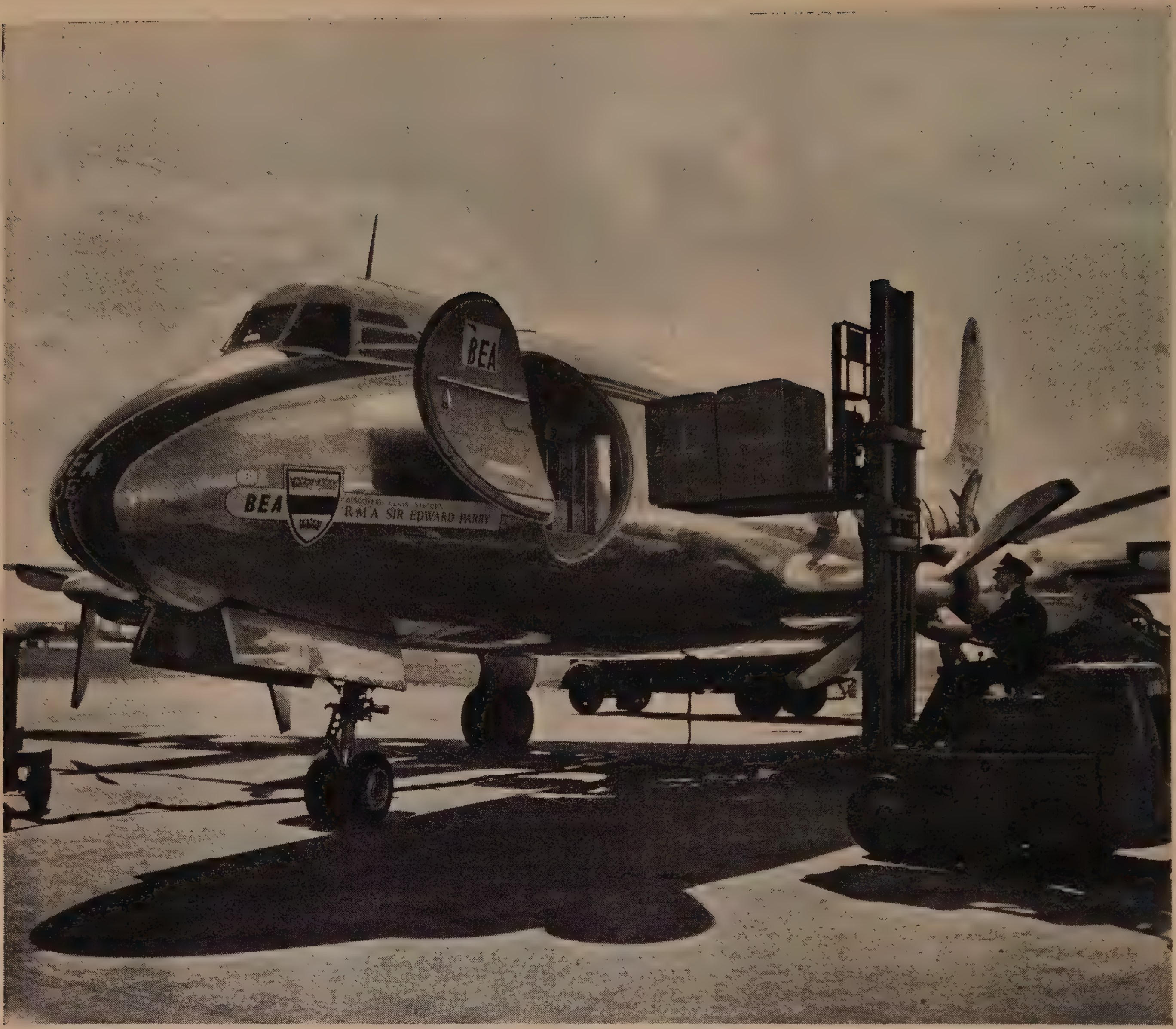

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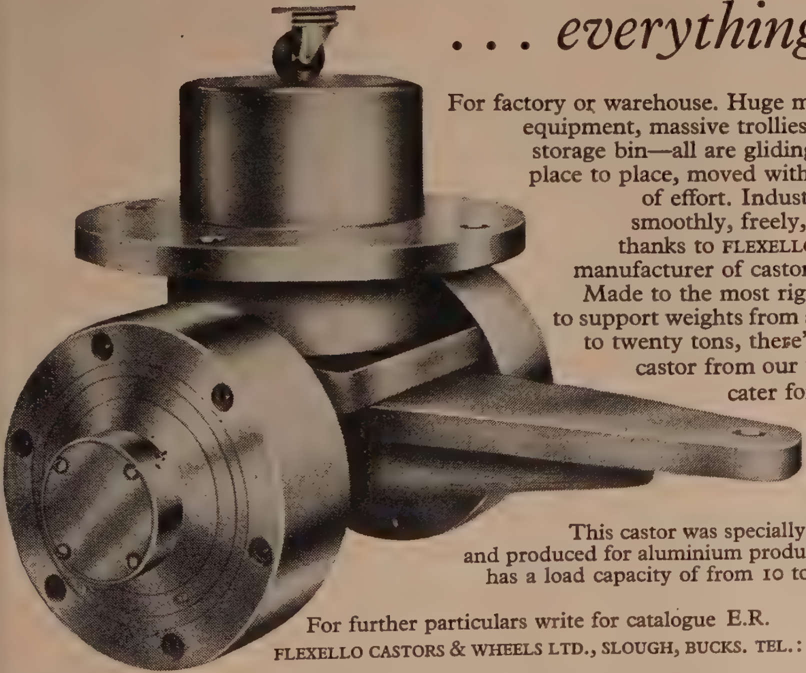

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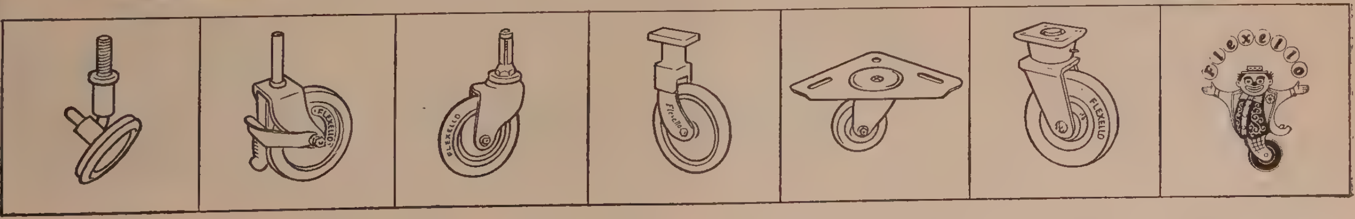

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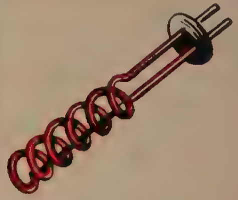
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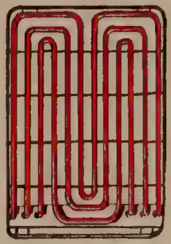
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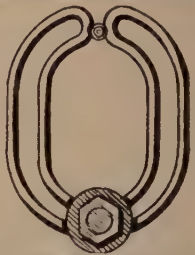
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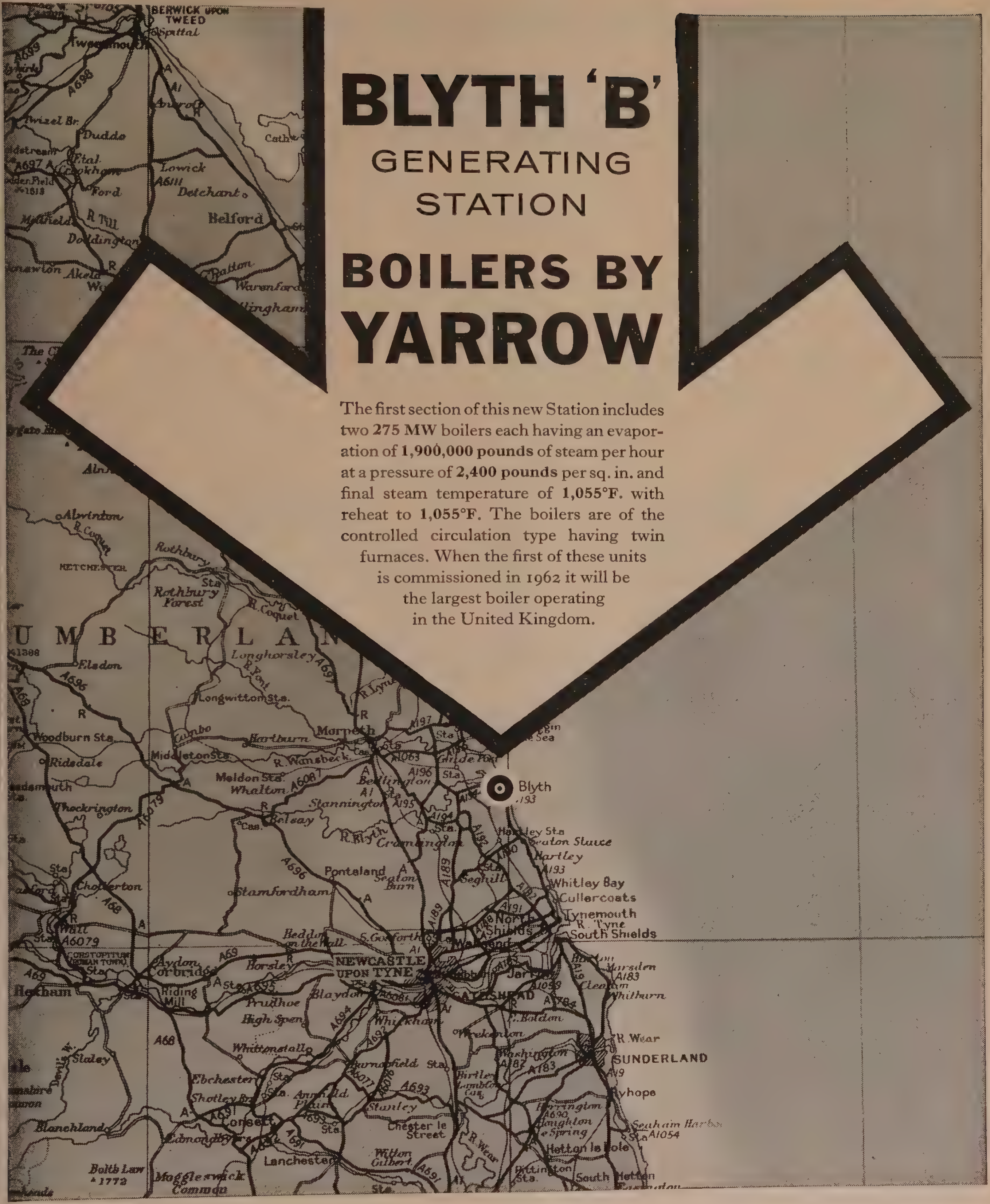

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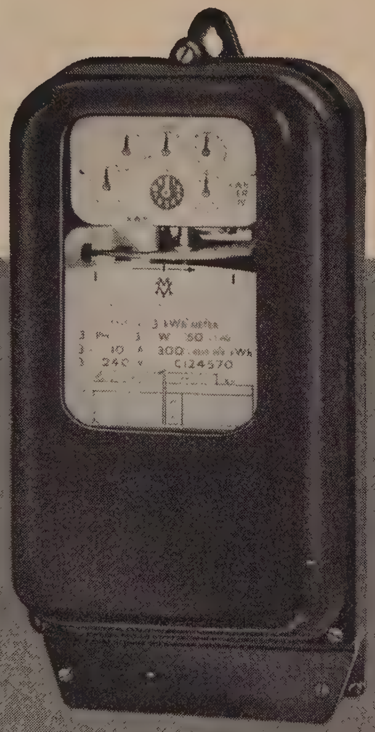

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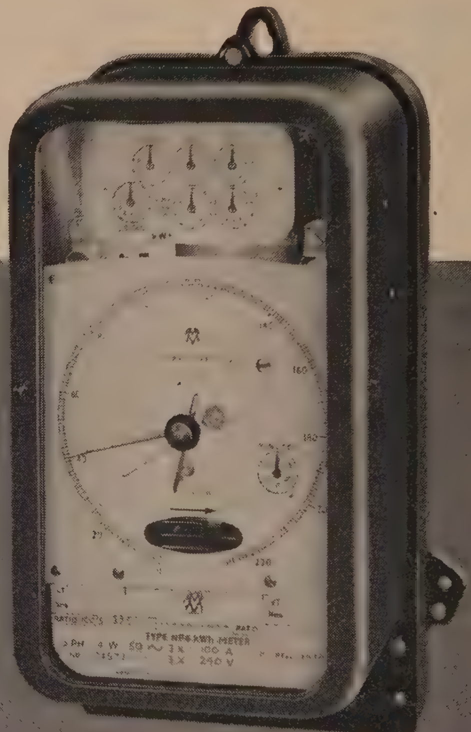

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1960

ELECTRICAL REVIEW

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A. R. POLLARD, A.M.I.E.E.

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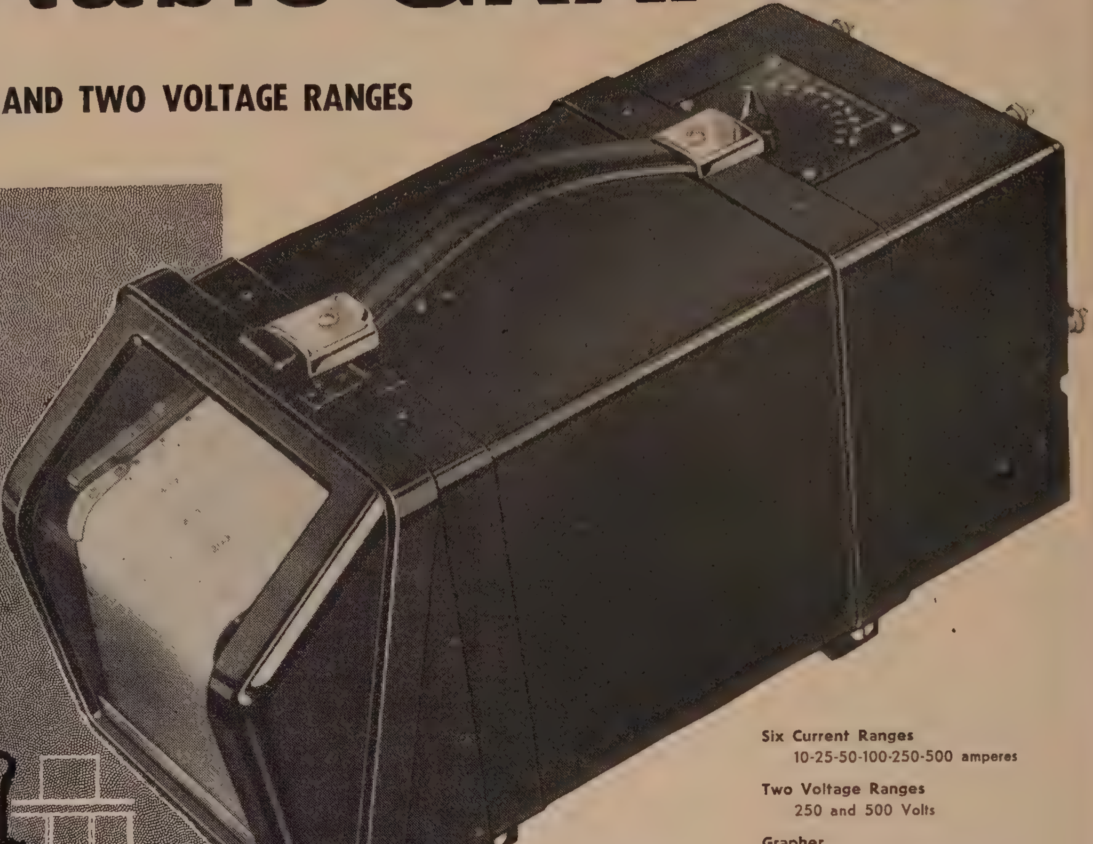

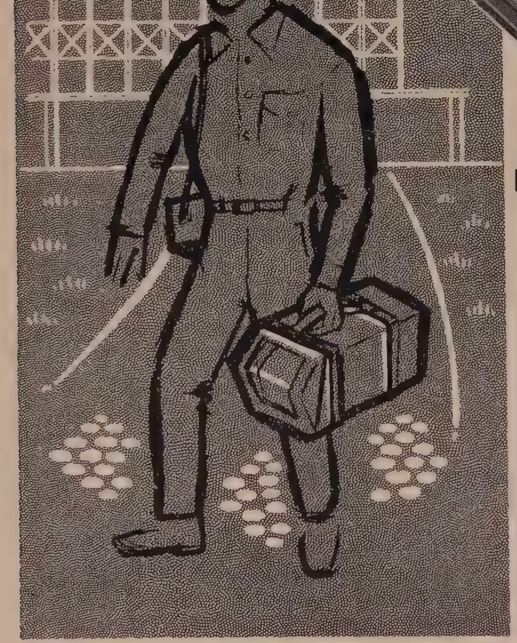

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ELECTRICAL REVIEW

8 January 1960 Vol. 166 No. 2 Established 1872

Coal Supplies

RECENTLY there have been indications that the stocks of coal which have been such an embarrassment to the National Coal Board are falling, in spite of the mildness of the weather. The Board stated last week that distributed stocks were at a lower level than at any time since 1950. This has caused the Ministry of Power to warn consumers that they should not allow stocks to fall further because weather conditions might possibly make it difficult to move pithead stocks rapidly. At the same time the Board's production was said to be about level with consumption. These facts make us wonder whether the coal mining industry is again approaching one of its periodical crises.

In 1955 the N.C.B. was able to meet requirements only by reducing exports and by " massive " imports, and in the following year the Board produced its programme " Investing in Coal," which was a plan for raising output in the face of the ever-pressing demand. The Board then said that the use of oil could be expected to grow rapidly and, later, nuclear power stations would provide a new source of energy. In spite of this, even in the longer term, problems of over-production of coal could scarcely arise. Thus, it will be seen, the N.C.B. had no qualms.

In fact the qualms were all the other way and the Ministry of Power encouraged the conversion of a number of power stations to oil firing. Earlier, that Ministry and the Lord President of the Council had presented their " Programme of Nuclear Power " to Parliament in which it was said that greater efficiency in the use of coal and the substitution of oil for coal in certain processes, including electricity generation, would give some limited relief, but the increasing demand for fuel could not be met without exploiting to the full any new economic technique available. It went on to enumerate the mining industry's difficulties in meeting the demands upon it.

The efforts made by many industries, including the electricity supply industry, to reduce their reliance upon coal were perhaps too successful, for about two years later there were signs of a slackening in the demand for coal and stocks began to accumulate. This led the Coal Board to suggest a reversal of the oil-conversion policy and the Ministry of Power subsequently requested the supply industry to revise its oil-firing programme. At the same time the miners hinted that the building of nuclear power stations might be slowed down and the number curtailed.

While it is possible for the Central Electricity Generating Board to adjust its oil-firing arrangements from time to time the expense and inconvenience are too great to warrant it. It is certainly not easy to adjust nuclear power projects in this way; in fact it is impossible to do so without wrecking the whole economics of the programme. Industry, and with it electricity supply, must continue to expand and it would seem that the National Coal Board will have to adhere to its 1956 plan of producing as much coal as it can, while recognising the need for supplementary sources of fuel and power.

SUPPLY AND DEMAND

A statement issued by the Electrical Power Engineers' Association last week suggests that the Electricity Council should ask the Institution of Electrical Engineers to reconsider its recent stiffening of the educational standards required for corporate membership. The statement contains a table showing that only a quarter of the technical staff of the supply industry is obtained via apprenticeships, while 35 per cent are promoted from manual grades and 39 per cent are recruited from outside the industry. Over the past four years, the annual graduate trainee entry has included an average of only seven men holding university degrees.

We consider that the small number of university graduate entrants combined with the figure of 39 per cent of the technical staff recruited from outside the industry is deplorable. On many occasions in the past we have commented on the dearth of facilities for practical training. The number of apprentices employed by the larger electrical manufacturing firms has reached saturation point and it is hoped that the smaller firms will co-operate to form training groups. The nationalised industry benefits from these efforts when it annually takes 39 per cent of its staffing requirements from private industry. It is therefore hoped that the statement issued by the E.P.E.A. will receive very careful consideration by the Electricity Council particularly in this connection.

DOMESTIC APPLIANCE EXPORTS

During the past twelve months manufacturers of domestic electrical appliances have led the boom in the home market but their export performance leaves much to be desired. Exceptions can be found in appliances and markets (and no doubt also in manufacturers) but, in general, exports of domestic appliances have been well below the 1958 level and they have been falling for several years. Imports, on the other hand, have increased sharply.

It has often been stated that a stable home market is an essential basis for an expanding export trade, but a recent study of the home and export sales of " consumer durable " industries in the main exporting countries has shown that there is no simple relation between the two. The forthcoming B.E.A.M.A. export conference will do most good if it succeeds in its aim of concentrating on practical problems involved in increasing exports. The conference has strong support, with the President of the Board of Trade, Lord Chandos and Sir Leslie Gamage among the speakers.

Next week's issue of the *Electrical Review* will contain a questionnaire the purpose of which is to analyse our readership and give readers an opportunity of stating their particular interests. We hope that they will assist us by completing and returning the form

THE HONOURS LIST

The outstanding feature of the New Year Honours List, from the electrical point of view at least, is the peerage conferred upon Sir George Nelson, who, as chairman of the English Electric Co., Ltd., has done great work for the electrical industry and for the country's export business. Two other men well known in the industry are among the new knights, Mr. J. F. Lockwood, chairman of E.M.I., Ltd., and Mr. A. B. Waring, chairman and managing director of Joseph Lucas (Industries), Ltd.

Among those who become C.B.E.'s are Mr. L. J. Davies, for his services as the B.T.H. director of research and education, Mr. A. J. Nicholas, managing director, South Wales Switchgear Co., Ltd., and Mr. H. T. Ramsay, director, Safety in Mines Research Establishment, Ministry of Power. The O.B.E.'s include Mr. E. J. Timberlake, managing director of the Electro Dynamic Construction Co., Ltd., and Mr. J. E. Whittaker, manager, Aberdeen Area, North of Scotland Hydro-Electric Board, who seems to be the sole representative of the electricity supply industry among the higher honours. We congratulate these and the others who appear in the list on page 79.

PORTABLE APPARATUS FAULTS

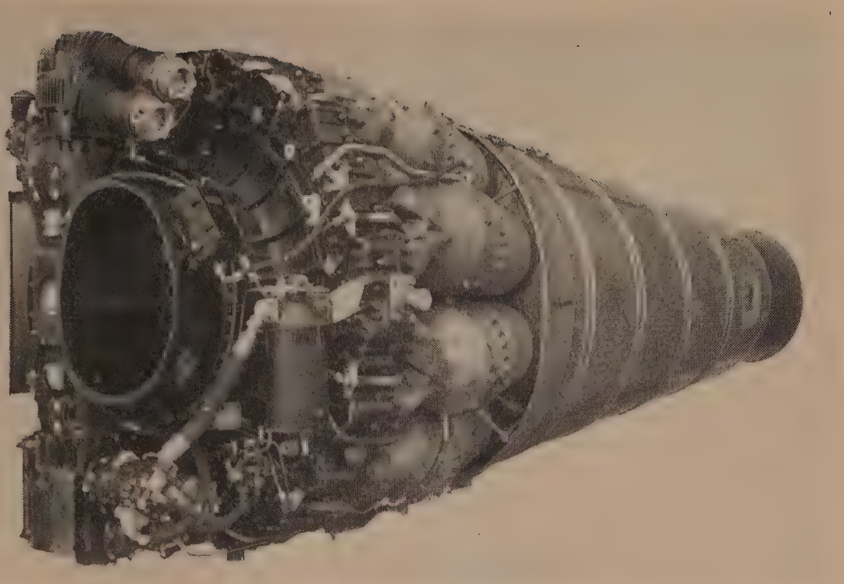
In previous reports produced by H.M. Factory Inspectorate on electrical accidents and their causes, it has been shown that electric shocks received from portable apparatus frequently arise from faults in the supply to the equipment. The most common cause is a broken or disconnected earth wire making contact with the " line " conductor and making the apparatus casing live. In the latest report (for 1958) a further analysis of this type of accident has been included, and this shows that for no less than one-third of these the apparatus itself was responsible. The remaining faults in the cables or flexible leads, in plugs, adaptors and couplings, or in the socket outlet or its supply wiring, were principally caused by damage or " wrong connections, badly made joints, insulation stripped back too far on conductors and earth wires tucked into lamp adaptors where there is no provision for earthing." These causes suggest installation by inadequately trained or ignorant people, a practice which has frequently been condemned.

The new information concerning faults in the apparatus is somewhat disquieting. Unfortunately, no indication is given of the age of the appliances, whether they were being correctly used, or how many shocks were caused by accidental damage, but the suggestion is that some mishaps were caused by inherent faults, presumably due to poor design, workmanship or inspection. Should this be the case, action must be taken by the manufacturers concerned, as it is reasonable for the user to expect that, damage apart, the equipment supplied will be safe to operate, and remain so throughout its useful life.

JET ENGINE CONTROL

UTILISING ELECTRONIC EQUIPMENT

By **H. E. COLES**, B.Eng.(Hons.)



As the aircraft gas turbine has developed, the associated controls have grown more complex. The control system simplifies the pilot's task by relieving him of the routine operation of levers and switches and the watching of gauges. During flight the necessary continual adjustment of many of the engine variables can be carried out automatically without the human operator. This article outlines some of the principles which govern the choice of control system and indicates how these controls have been evolved, many requirements having been met by the use of electronics

A HIGH-SPEED aircraft propels itself by reaction—air is accelerated to a high velocity and ejected rearwards, the reaction being transmitted to the aircraft via the engine mountings as a forward thrust. The turbine engine has four main parts: a compressor, a turbine, a combustion chamber and a nozzle. Two types of compressor are used, centrifugal and axial flow, but most engines utilise a multi-stage, axial-flow compressor driven by a single-stage turbine. The direct control of thrust is by fuel input and it is generally accepted that the pilot should move only one power lever. The amount of fuel required to run the engine at constant speed is a function of speed and compressor inlet pressure and temperature. The fuel system must be sensitive to these parameters, with the fuel flow controlled by the pilot's throttle lever to a pre-set law. As an aircraft changes altitude and forward speed with a fixed throttle lever position, the fuel flow must be compensated for changes in the ram intake pressure and temperature.

On the early engines a simple thrust control consisted of a single fuel pump, a manually operated throttle valve and a set of burners. The valve was merely adjusted to provide the fuel pressure at the burners corresponding to the required flow at a particular engine speed, no allowance being made for the varying engine fuel requirements at high altitude. Later, a barometric pressure control was added to vary the fuel pressure as a function of ram intake pressure, since the relationship between fuel pressure and intake pressure is nearly linear up to an altitude of about 35,000ft. This control sensed an error signal between altitude pressure and fuel line pressure and by-passed fuel from a fixed-stroke pump or controlled the stroke of a variable-stroke pump.

The control system must allow the engine to produce the maximum allowable thrust when selected by the pilot, and be able to respond quite rapidly to new commands. During operation, it is necessary to avoid " stalling " the compressor blades, overheating and overspeeding the turbine, or having combustion flame extinction—" flame-out." When a compressor stalls, the aerodynamic conditions within it give rise to air flow reversal and the combustion chamber becomes starved of air. The rich gas mixture that ensues will quickly burn out and damage the turbine. Any excessive temperature changes that may occur during an acceleration, stall or flameout, can be avoided by using an air-fuel ratio control which is responsive to jet-pipe temperature. Because the latter involves the use of thermocouples, which have a considerable time lag and during rapid acceleration would not provide an adequate protection, present designs use a mechanical air-fuel ratio control which senses air mass flow (proportional to compressor delivery pressure) and metered fuel pressure.

Automatic Temperature Control

The maximum permissible speed of an engine depends upon the acceptable stresses in the turbine blades and disc at a given speed and temperature, and any rise in speed or temperature will increase the stresses and cause damage. Should mechanical damage occur, possibly producing air leaks or causing blades to foul the casing, the efficiency would drop, leading to a temperature rise at the turbine inlet since the governor would allow more fuel to flow into the engine to maintain speed. To prevent this, an automatic temperature trim control is incorporated in the fuel system.

At the gas entry to the turbine, temperatures may reach about 2,000°F and are too high to be conveniently measured. Temperature sensors are therefore placed in the gas stream leaving the turbine, since the two temperatures are approximately proportional. The control illustrated in Fig. 1 shows how sensed jet pipe temperature can trim on engine fuel flow. A number of chromel-alumel thermocouples connected in parallel in the jet pipe generate a small d.c. voltage proportional to the difference between the measured temperature and a certain datum temperature. The signal is supplied to a magnetic amplifier, the output of which is fed to the solenoid of an electromagnet. The spring-loaded armature operates the pump servo controlling the fuel flow to the engine. This control is generally known as the "electric pressure control."

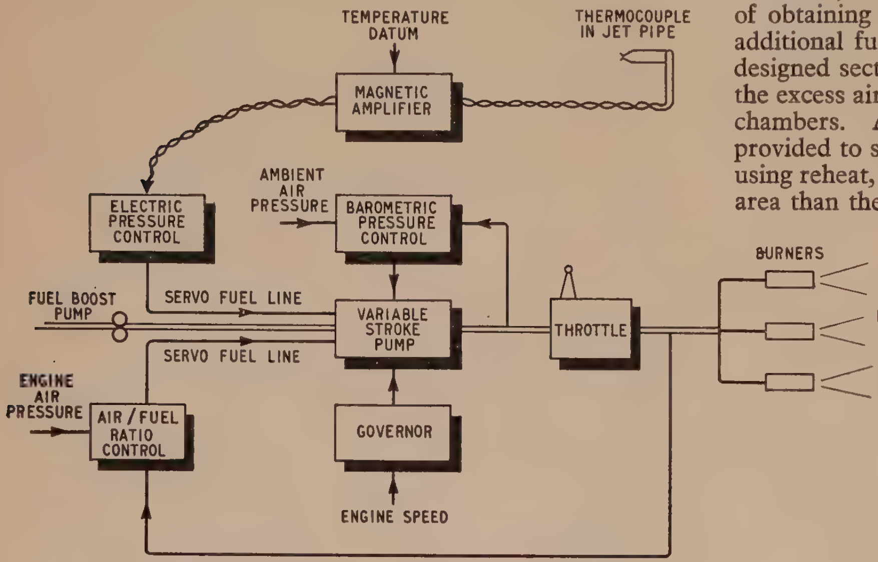


Fig. 1.—Schematic arrangement of an automatic temperature control system

When altitude is gained on a full, fixed throttle position, it is characteristic of the normal jet engine fuel system that a steady rise in engine r.p.m. and jet pipe temperature occur. Even if the throttle is manually retarded to reduce the r.p.m., the jet pipe temperature will still rise, since it increases considerably with altitude at a given engine speed. The fuel flow to the engine can be automatically decreased for a fixed fuel pump output pressure, and so control the maximum turbine speed. Fig. 2 shows a servo throttle unit inserted between the fuel pump and the manual throttle. The current applied to the solenoid-controlled throttle increases the fuel pressure drop across the valve. The a.c. output from an engine-driven tachometer generator, the frequency of which is proportional to the r.p.m., is fed into a magnetic amplifier unit incorporating a speed discriminator and rectifier, producing two d.c. components. One is proportional to the voltage and frequency, while the other is proportional to voltage only. These d.c. components are fed to a three-stage magnetic amplifier and they can be cancelled at any desired speed by the opposing voltage of an r.p.m. datum selector. With the selector set at maximum engine speed, no signal is applied to the amplifier circuit and, therefore, no output current flows at this balancing condition.

At any speed other than that corresponding to the selected balance point, a signal is produced of polarity and magnitude proportional to the speed above or below the null point. A drop in the engine speed causes signals to be suppressed, but signals arising from an increase in speed are amplified and operate the solenoid of an electromagnet similar to that used in the electric pressure control. The magnet armature pivots a beam, uncovering a small servo valve and dropping the fuel pressure across the servo throttle unit which cuts down the fuel flow to the burners, the turbine speed dropping accordingly.

At an altitude of 23,000ft a compensating unit responds to the variation in ambient pressure. This consists of a potentiometer fed with a d.c. voltage, the slider being moved by a static pressure sensor. The slider voltage, proportional to altitude, is fed into the amplifier and used to bias the first stage and increase the output current to the throttle servo operating solenoid, cutting the fuel flow and reducing the r.p.m., thus holding the jet pipe temperature at its maximum safe value at all altitudes and speeds.

One of the advantages of using an electrical governor is that the control is unaffected by variations in fuel density and viscosity at a time when aircraft are operating on fuels of widely differing grades. The electrical governor uses the standard 115 V, 400 c/s aircraft invertor supply.

Reheat, sometimes called "afterburning," is a method of obtaining extra thrust from a jet engine by injecting additional fuel downstream of the turbine in a specially designed section of the tailpipe. This fuel is burnt with the excess air not previously used in the main combustion chambers. Adjustments of the nozzle area have to be provided to secure the best aerodynamic conditions when using reheat, opening up to as much as 50 per cent greater area than the minimum area to keep the flow conditions upstream constant. The operation of the reheat must not, however, affect the engine running conditions.

In the reheat section, the air and the fuel are both scheduled according to some pre-set law by the

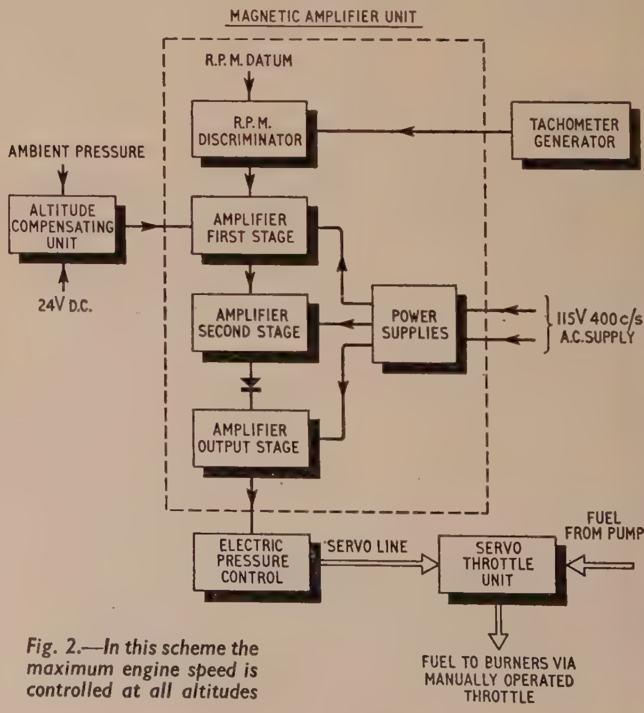
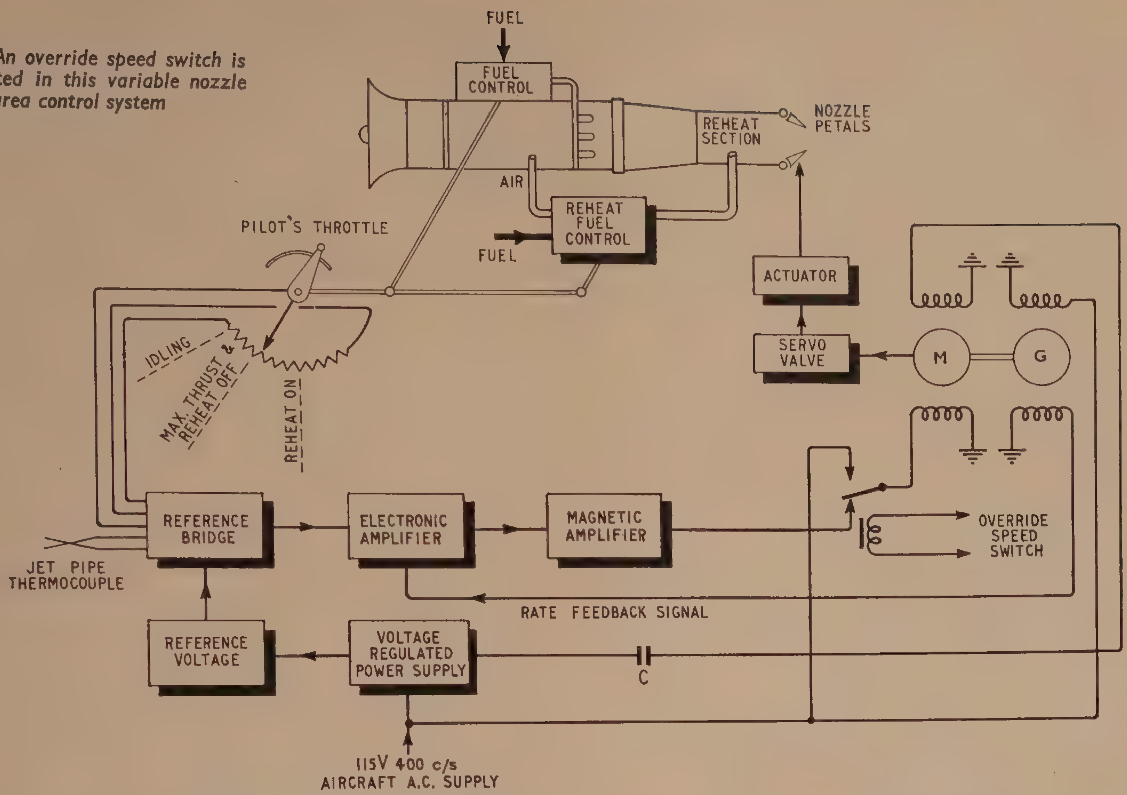


Fig. 2.—In this scheme the maximum engine speed is controlled at all altitudes

Fig. 3.—An override speed switch is incorporated in this variable nozzle area control system



thrust selector. Such a schedule can be arranged, provided that the engine is brought up to its maximum speed, by linking the reheat fuel control to the pilot's throttle lever mechanically through a suitably designed cam. A control of the nozzle to give the desired turbine temperature-degree of reheat law is shown in Fig 3. A wire potentiometer is mounted on the control lever selector and the d.c. slider voltage is compared by means of a bridge network with a pre-set datum. The error signal produced is amplified and used to control the field of an electric motor which rotates a cam to operate a small hydraulic or pneumatic servo valve. The operating fluid flows to the actuators for opening or closing the nozzle. This control also provides a top temperature override by connecting jet pipe thermocouples via a bridge circuit to an electronic amplifier. This signal operates the motor.

A limitation of maximum safe speed can be provided by connecting the amplifier in two ways: to an override speed switch operated by a mechanical governor, or to a tacho-generator override signal from the engine. If an excessive nozzle overshoot occurs, it is liable to cause surging within the engine, but this can be prevented by using a correction rate signal provided by the generator attached to the motor shaft. Error rate signal and correction rate signal feedback are employed, and to avoid drift in the d.c. amplifier, a mechanical chopper is used.

An alternative control arrangement can be used with a synchro control transmitter mechanically coupled to the cam-box and electrically connected to a control transformer, which is coupled to the servo valve. This transformer produces an output voltage, proportional to the error between its shaft position and the transmitter shaft position, which is amplified and used to control a servo-motor geared down to drive the cam connected to the servo valve.

Integrated Control

In the United States attempts have been made to connect many engine controls to simplify the pilot's task. In such a system a central computing unit dealing with all the aerodynamic and engine operating conditions is necessary. A simple, early integrated control has been envisaged on the J47-17 engine which powered the North American F-86D interceptor aircraft. With a single lever control, engine speed was kept constant to very close tolerances for all flight conditions. Fuel flow was metered to the burners by a valve operated by a two-phase a.c. motor, controlled by the pilot's lever and incorporating position feedback. Engine speed was selected and compared with an engine-driven tachogenerator, the error signal being amplified before being used to drive a motorised fuel valve. Jet pipe temperature limits and maximum speed limits were imposed on the schedule, in conjunction with maximum and minimum flow controls.

The engine intake control is particularly suited to be integrated with the inlet, engine and airframe conditions at supersonic speeds. To appreciate the special requirements of a variable geometry intake, a brief explanation must be given of the operation of the intake diffuser. The air entering the engine must be delivered to the first row of compressor blades via an inlet duct or cowl with as little loss as possible in converting the kinetic energy of the intake stream into pressure energy in the diffuser. At supersonic speeds, shock losses are set up by the normal shock wave which forms ahead of the engine cowl, with a consequent reduction in the engine efficiency and with increased drag. The cowl shape must therefore be automatically varied so that the engine inlet will run to capacity and give a good pressure recovery for speeds greater than about Mach 1·5.

In wing-mounted engines with circular intakes, a movable centre body with a conical nose is used as a variable geometry configuration. An external compression wave is created ahead of the terminal shock at the throat of the diffuser by the spiked centre body which projects forward. Spillage ports are used to bleed-off any excess air flow to position the normal shock wave correctly at the cowl lip. After extensive wind tunnel research and flight testing, the closed-loop intake control shown in Fig. 4 has been produced. This positions the movable centre body according to a schedule of normal shock wave position. The difference between the scheduled position and the actual centre-body position produces an error signal which is amplified and used to re-position the centre body via a controller, thus cancelling the error.

Four probes are normally used to sense the shock wave position, each protruding from inside the cowl lip and having a number of pressure tappings along its length. Any pressure difference between the normal shock wave occurring at one of these tappings and the pressure at a scheduled shock position is then converted to a voltage error which is amplified by a transistor amplifier. This amplifier is capable of feeding either d.c. or a.c. power to an electric motor which moves the centre body.

Turbo-Jet Simulation

Intake and final nozzle controls can be extremely complex. Most of the closed-loop controls require the engine or the aircraft dynamics to provide the necessary feedback path, and present the problem of interaction. During a transient one of these closed loops may have an unstabilising influence on another. An analysis of the systems can be carried out by using standard mathematical methods or by an analogue computer. This can simulate the physical control system for linear or non-linear analysis.

In developing a control system, electronic simulation of the engine, based on predicted engine performance characteristics, is essential to attain an optimised system. To obtain engine characteristics, response tests are made to determine the transfer function or transient relationship between several engine parameters, e.g. the reaction of engine speed, compressor delivery pressure and jet pipe temperature to a sudden change in fuel flow, by putting in step changes of fuel or by injecting a sinusoidal fuel flow. The latter method of "harmonic response" testing involves measuring both input and output signal amplitudes and accurately determining the phase difference at various frequencies. Harmonic or transient testing has been possible only by using electric capacity-type pressure transducers, to measure the pressure of gases or fuel flows, and the electrical speed signal produced from a tachogenerator. Jet pipe temperature signals are obtained from high-response thermocouples connected in series and placed radially around the tail-pipe. These signals are filtered to reduce the noise component and are subsequently monitored on oscilloscopes or on a multichannel recorder. The phase shift between the components is either measured directly from the sinusoidal recordings or by reading the in-phase and quadrature components of the output with respect to the input reference signal, using standard function analyser equipment.

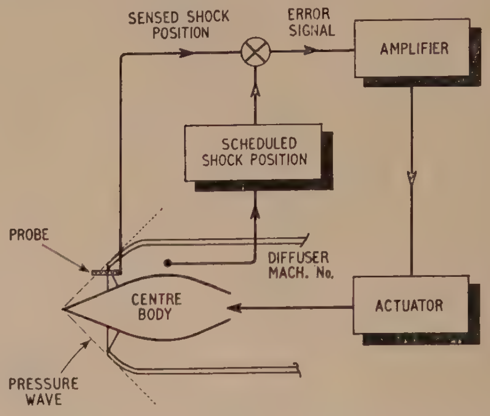


Fig. 4.—Simplified arrangement of a variable geometry intake control

Electronics plays an important role in the control of the present-day turbo-jet, whether applied to the control of jet engines in computer form for simulating their controls, or used in an airborne control system. The ease with which signals can be rapidly transmitted from standard transducers and amplified enforces the adoption of the electronic media for both test-bed and in-flight engine control. With the arrival of transistors and other miniature components, compact and very light, serviceable equipment can be used. In the stratosphere, the ram air temperature exceeds 150°C at high flight Mach numbers and temperatures of about 250°C and 300°C could be experienced very easily. It is to be hoped, therefore, that manufacturers are developing electronic components capable of withstanding the high temperatures that are foreseen.

Approving Electrical Equipment for Export to Canada

PROGRESS of the British Standards Association/Canadian Standards Association Approvals Agency was reviewed at a recent meeting in London of the United Kingdom Advisory Committee.

Mr. J. P. Roberts, secretary of the Committee, reported that the rate of application for approval had steadily increased during the past year and that the number of approvals now stood at 220. The Approvals Agency staff had moved in June, 1959, to the new B.S.I. testing centre at Hemel Hempstead. New engineers had been appointed and trained, and with additional work taken on in connection with certain B.S.I. kite-mark schemes, a better load factor and greater efficiency had been achieved. A manufacturer seeking approval was now visited usually within 14 days of making application. In previous years the delay had been four to five weeks. The agency still carried out a fair proportion of routine re-inspection work in connection with approvals, and consultant services and special acceptance services were also maintained.

It was also reported that although there had been a slight increase over the last two years in the cost of carrying out work in the United Kingdom, the Canadian charges for completing the work had been reduced, the net result being that approval costs had remained much the same. It was noted that manufacturers apparently now accepted that there was virtually no alternative to obtaining prior approval before exporting electrical equipment to Canada and notwithstanding the expense and considerable work which were involved, few complaints had been received during the last two years in connection with this work.

At the meeting warm tributes were paid to the work of Mr. D. Maxwell Buist, who had explained that he considered it inappropriate to continue as chairman of the Advisory Council now that he was no longer export director of B.E.A.M.A. Mr. W. L. Sims, an assistant managing director of Wadkin, Ltd., was unanimously elected as the new chairman. Mr. Sims is a leading authority on the export of electrical machinery and with Mr. Buist was a member of the 1949 mission to Canada which resulted in the setting up of the Agency.

VIEWS on the NEWS

By REFLECTOR

Although an industry may be practically wholly mechanised there are some things which are still better done manually and homely devices are still used which though seeming to be out of date have not yet been superseded by modern methods. The following case does not strictly fall into the latter class, but it is an example of the use of a simple and unusual "dodge." It is reported as follows in *Regional Power* (the magazine of the Eastern, London and South Eastern Region of the C.E.G.B.):—

> "The lighting up of oil-fired boilers at Littlebrook has taken over 15 minutes with the normal methods of electrical ignition or with paraffin. Instantaneous success, however, is now being achieved by the use of the ordinary 'Golden Rain' firework."

The device may, of course, be better known in Chinese power station practice.

* * *

Mr. P. Arklow, of London, S.W.5, has drawn my notice to a recent article in the *Daily Express* which is a notable contribution to the enlightenment of the public in electrical matters. It begins:—

> "The cheapest, newest way of heating a home is called space heating, and though the theory of it is as complex as space travel, in practice it is as easy as flicking a switch. The heating is electric and comes in flat panels, which are fixed to the wall with a few screws. It gives out the same heat as a two-bar electric fire, but at exactly one-quarter the running cost—under ½d an hour. There is no open element. Space heating heats the air, but doesn't dry it."

My correspondent suggests that there may be a "hygroscopic watt."

* * *

On the authority of the *Irish Independent* I said in my notes of 18th December that the "Electricity Supply Board" was concerned in the supply of electricity to houses in Lisnaskea. A Belfast reader (Mr. J. K. Kearney) points out that as Lisnaskea is in Fermanagh the body concerned is the Electricity Board for Northern Ireland; the E.S.B. operates in the Irish Republic. Knowing how delicate susceptibilities are in that divided country, I am glad to give this explanation.

* * *

A contributor to the *Stirling Journal* complains of the too-prominent labels which some manufacturers affix to their domestic appliances, electrical and otherwise. I, too, have often thought about this, but without taking any action. Maybe it is not a very bad practice when applied to lavatory tanks and such, but the labels are not very tasteful ornamentation for equipment which meets the eye more constantly. As we have got used to it and nobody else seems to worry about it, I suppose no harm is done.

* * *

Meters, as other equipment, are prone to "teething troubles" and so I suppose there is nothing extraordinary about the following note from the Eastern Electricity Board's magazine:—

> "We heartily welcome back Mr. . . . who returns to us as Meter Tester in the Single Phase Laboratory after completing his National Service with the Royal Army Dental Corps."

* * *

There was an echo of the "gas and water socialism" which animated several London borough councils fifty or sixty years ago in the obituary notice of Mr. E. W. B. Gill which appeared in *The Times* last week. Describing how he came to be involved in Oxford's municipal affairs, Mr. Gill is said to have written:—

> "I had no ideals of public service. I only went on to the Oxford City Council because I was infuriated over the price of electricity and I hoped to kick the company out."

He was successful and for a few years, until the nationalisation of the electricity supply industry, acted as chairman of the Electricity Committee which was set up when the Council acquired the Oxford undertaking.

* * *

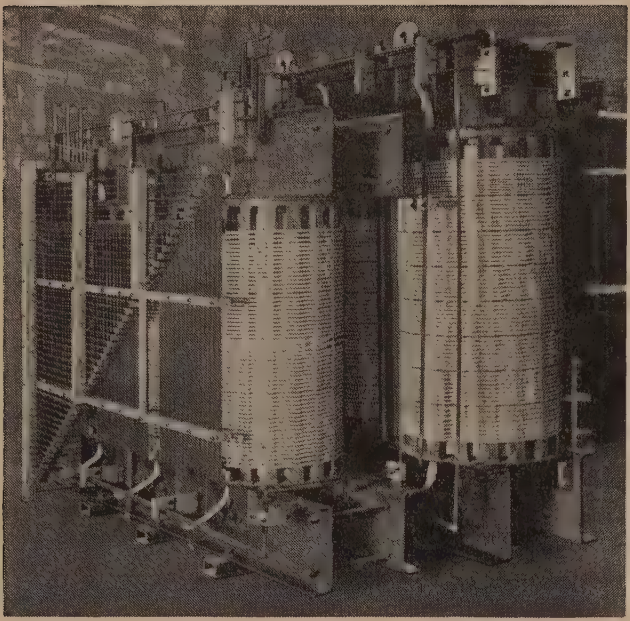
The National Coal Board and the miners have been perturbed during the past year or two about the oil-firing of power station boilers. In view of this the following note from the *Electrical Review* of 5th January, 1900, is of interest:—

> "It is more than likely that the cost of production of electricity may be materially affected in the next few months if the price of coal continues to increase at the present rate. There are pessimists who declare that ordinary household coal in London will touch £3 per ton before the present crisis is past; if this is realised it will be exceedingly serious for ordinary households, and it will be of the gravest importance to electric lighting companies. The present cost of coal per unit in London averages nearly 1d, and it will be readily seen that if coal costs thrice its present price, the handsome profits that one has been accustomed to associate with London companies will be very much diminished. If difficulties do arise on the question of coal, we are afraid that electric lighting concerns (especially when we take into consideration the difficulties of keeping up a supply) will not have a very cheering prospect before them. Such a crisis might not be altogether an unmixed evil, for it might induce more experimenting in the direction of oil-fed furnaces and low-class fuels, which have been recently discussed by the Institution of Electrical Engineers."

ARC FURNACE

MODERN DESIGN DEVELOPMENTS

By C. R. HATCH, A.M.I.E.E.*



Regulating and main step-down transformers for an 18 MVA 33,000/385-126 V three-phase type OFW furnace equipment fitted with on-load tap changer

DURING the past few years a considerable increase has occurred in the use of the electric arc for the provision of controlled heat for both metallurgical and chemical purposes. This can be attributed, particularly in the case of the steel industry, to two main factors, namely, the increasing use of scrap for steelmaking, and the saving of man-power and capital cost which can be achieved with arc furnaces compared with other methods of heating. Electric arc furnaces taking power up to 40 MW or more are now being used.

There are two main types of furnaces in general use, one employing an exposed and the other a submerged arc. The former type is used for melting and refining steel and the latter for the melting of non-metallic materials, oxide reduction in the production of phosphorus, and other electro-chemical processes. In each case the power requirements of the furnace are similar, consisting of very heavy currents up to 30,000 A or more at up to 450 V. It is necessary, in order to obtain optimum performance from the furnace, to be able to vary the voltage supplied to the furnace electrodes over a range of some $3\frac{1}{2}$ or 4:1. The modern furnace transformer has to be designed to meet these electrical requirements and to withstand frequent short circuits on the l.v. side, and the accompanying electromagnetic forces, without sustaining any damage.

At one period transformers for large three-phase furnaces consisted of three single-phase shell or core type units. With this arrangement it was possible to carry a spare single-phase unit. As transformers proved to be increasingly reliable, the practice of installing a single three-phase transformer increased, resulting in a saving of space and a higher efficiency. It is now normal British practice to supply, even up to the largest sizes, one three-phase transformer, usually of core type construction.

On the Continent and in the United States, however, shell type cores have been used recently on sizes up to 30 MVA and 42 MVA respectively, the former in conjunction with a steel melting furnace and the latter with a submerged arc furnace. Deciding the type of construction to be used depends to some extent on the normal practice of the manufacturer but in some cases the furnace requirements tend to be the major factor in the choice. For instance, in the case of the 42 MVA transformer already mentioned, a reactance of 6 per cent was specified and to meet this figure it was considered that a shell type would be the best design.

The recent introduction of cold reduced oriented steel (c.r.o.s.) has enabled the designers to use higher flux densities and this has resulted in smaller transformers, a distinct advantage when the space available to accommodate the transformer close to the furnace is often very restricted.

Since heavy and frequent short circuits are to be expected during the melting period of steel furnace operation it is essential to take precautions to minimise the effects of the electromagnetic forces set up by the heavy currents. To stabilise the arc and to limit the current and voltage drop on the system to which the primary of the transformer is connected it is usual, on transformers below about 10 MVA, to include a series reactor in the circuit. This limits the short-circuit current, and lessens the stress on the windings. In large installations the higher inherent reactance of the transformer, together with that of the associated l.v. and furnace leads has the same effect, and the series reactor may not be required.

A typical interleaved arrangement of the windings for use with a shell type transformer is shown in Fig. 1 (a). The windings in this case consist of four groups of h.v. and l.v. coils which can be connected in the way most suitable for obtaining the requisite current and voltage,

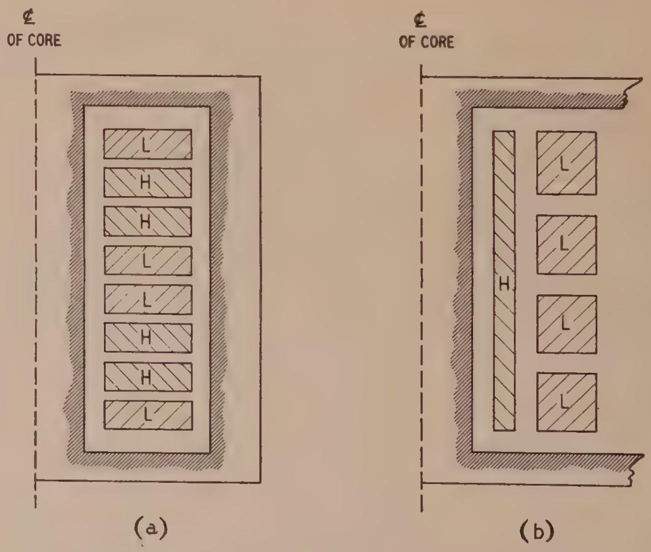


Fig. 1 (a).—Shell type transformer with interleaved windings

Fig. 1 (b).—Core type with concentric windings

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* Transformer Engineering Department, A.E.I. Transformer Division, Manchester.

TRANSFORMERS

Electric arc furnaces for both metallurgical and chemical applications have increased recently in both numbers and size, units requiring over 40 MW now being in service. The operating characteristics of the arc furnace give rise to a number of special design features in the associated transformer, and in this article the author discusses these, particularly in relation to the core and windings and secondary voltage variation. P.f. correction and cooling methods are also dealt with

provided that care is taken to ensure that with any tapping connection the parallel connected l.v. coils share the load adequately.

With this type of construction the electromagnetic forces between groups are largely axial, balancing each other on the inner groups but affecting the whole of the end coils. These are firmly supported over a large area by the core and over the remainder by clamps. The insulation between coils, however, is subjected to these forces and must be carefully positioned to give adequate support to the coils and at the same time to form suitable cooling ducts.

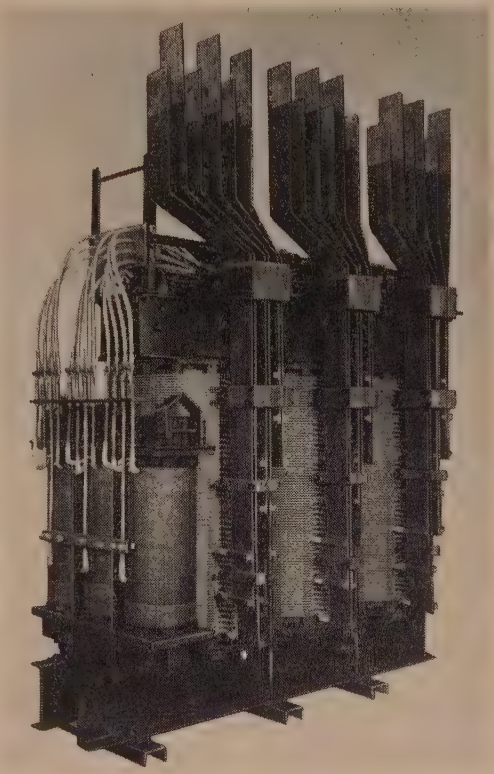
Current British practice has usually adopted the core type design with concentric windings. The h.v. winding, with or without tappings depending on the method of secondary voltage variation, to which reference will be made later, is placed next to the core as in Fig. 1 (b). On the outside, to facilitate the connection of the heavy current leads, are a number of l.v. coils, each consisting of relatively few turns. These coils are connected in parallel with heavy copper bars. Owing to the ampere-turn distribution of the h.v. winding the separate coils of the l.v. winding carry equal currents. The resultant electromagnetic forces under short-circuit conditions with this arrangement are almost entirely radial, and can be relatively easily sustained by suitable core to h.v. packing and appropriate copper section for the l.v.

In addition to being subjected to short circuits, furnace transformers, particularly during the melting-down stage in a steel furnace, have to withstand the effects of interruptions of the l.v. current on one or more of the phases, caused by the sudden extinction of the arc. These interruptions give rise to voltage surges in the windings. Also, in the case of transformers with off-circuit voltage regulating equipment, the windings are subjected to many more switching operations than a normal power transformer. It is, therefore, customary to increase the insulation level of furnace transformer windings to a value somewhat higher than for power transformers of the same voltage class.

Secondary Voltage Variation

It has already been stated that l.v. variation over a wide range is required for furnace operation. Owing to the impracticability of tapping the heavy section l.v. winding, it is necessary to adjust the secondary voltage by tappings on the primary side. This can be achieved in two ways. The first is to tap the h.v. windings and thereby, for a constant h.v. voltage, vary the secondary voltage. The second is to supply the primary of the transformer with a variable voltage by a primary regulating transformer.

In actual practice, the first of these alternatives is usually adopted when the supply voltage is below 33 kV and off-circuit tap changing is acceptable, and the second is used at higher voltages or when on-load tap changing is required. Although much interest has been shown recently in large furnace transformers fitted with on-load tap-changing gear, many smaller transformers are still built with off-circuit switches, as they are less expensive.



Low-voltage side of a 4,500 kVA 11,200/200-81·5 V three-phase transformer with tapped series reactor

With off-circuit tap changing the transformer must be disconnected from the supply during the operation of the tapping switch. Since the switch can be motor operated and, if necessary, remote controlled, little time need be wasted in the operation. In some cases the change of tapping can be made during a necessary suspension of furnace operation for metallurgical or other reasons. The duty on the circuit-breaker is, however, severe because of the frequency at which it is used.

Since the maintenance of the correct power input to the furnace is of great importance, and the conditions during the melting period are continually altering, the number of tap-change operations required is greatly in excess of that for which an off-circuit tap changer for a conventional power transformer would be designed. Special heavy duty tapping switches for frequent operation and heavy overloads have been designed to ensure reliability and to minimise maintenance.

The switch is usually a self-contained unit in a tank fixed to the side of the main tank. An insulating oil-tight terminal board separates the switch chamber from the main tank, enabling the switch contacts to be inspected without the need to lower the oil level in the main tank.

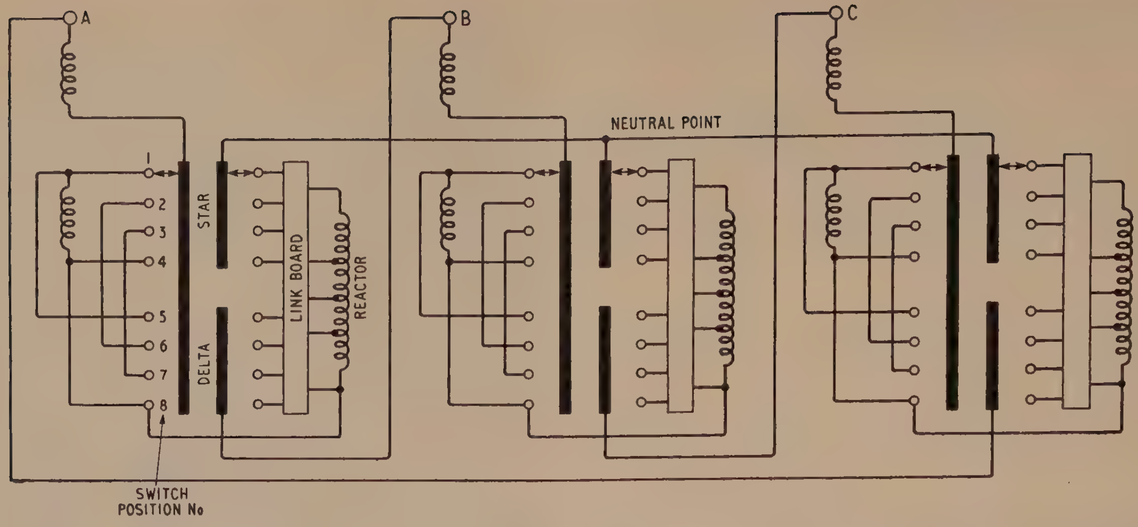


Fig. 2.—Diagram of an eight-position three-phase delta/star change-over switch with provision for varying the proportion of series reactor in circuit for each switch position

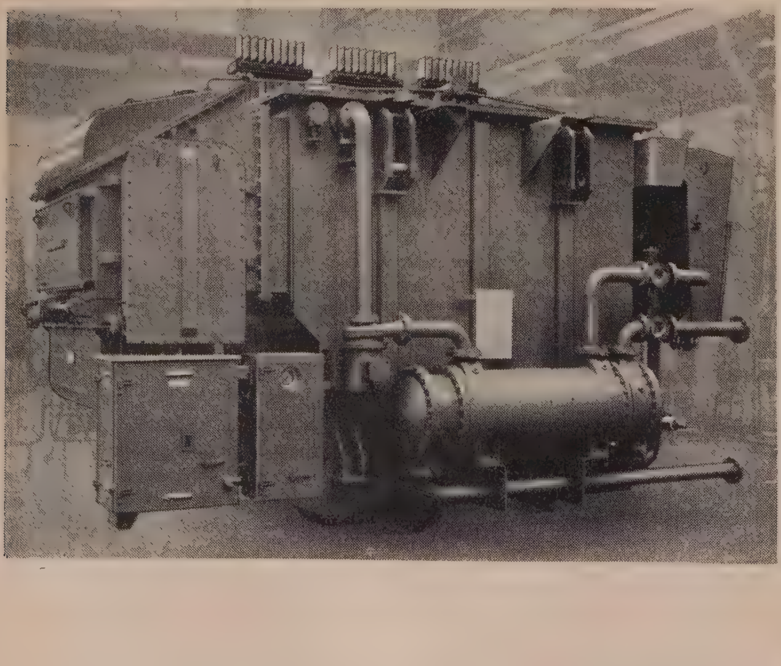
Owing to the necessity for frequent operation, furnace transformer switches are normally motor driven and the driving arrangements, consisting of motor, brake, gearbox and auxiliary switches for remote electrical control and tap position indication, are similar to those for conventional on-load tap-changing equipments. Since the possibility of inadvertent operation without disconnecting the main supply cannot be ruled out, it is usual to incorporate interlocks with the main circuit-breaker in the tap-changer control.

The loading of a steel furnace transformer is usually such that after a period of delivering maximum power to the furnace to melt the charge as quickly as possible, both the secondary voltage and current are progressively reduced whilst refining takes place. The number of secondary voltages provided may be anything from four for small furnaces up to as many as 14 on large equipments, and is usually determined by the furnace designer, as dictated by service requirements.

Owing to the reduction in power at lower voltages it is possible to reduce the number of tappings on the h.v. windings by the combined use of a number of tappings with a change of primary phase connection from delta to star. This change of connection is made by the tapping switch and a typical arrangement is shown in Fig. 2. From the four tappings shown it is possible to obtain eight secondary voltages, four with the h.v. phases delta connected, i.e. switch positions 5-8, and four lower voltages, each 57·7 per cent of the first when the h.v. is star connected in positions 1-4. It will be noted that the tapped portion of the winding is arranged to overlap the main winding. This ensures that when minimum h.v turns are in circuit the voltages across any part of the transformer cannot, by auto-transformer effect, be greater than the line voltage.

For purposes of arc stability and short-circuit current limitation the reactance required in a furnace transformer can vary from a low value up to 30 per cent depending on the amount of reactance present in the external circuit and the requirements of the service. In general, on larger steel furnace equipments of 10 MVA and above, the combined transformer and circuit reactance is adequate but below this rating it is customary to include a separate reactor in series with the primary winding. Tappings are taken from this reactor, which is usually mounted in the same tank as the main transformer, first to a link board and thence to contacts on the off-circuit switch as shown in Fig. 2. With the arrangement shown it is possible to include any proportion of the reactor in circuit for any of the star or delta switch positions. It is more usual, however, to utilise the reactor in the delta positions only, since it is with this connection that the melting-down process is carried out, during which most reactance is required. In addition, it is characteristic of a transformer with h.v. taps for l.v. variation that as the secondary voltage is reduced the inherent reactance of the transformer expressed as a percentage is increased, so that there is less need of extra reactance.

An 18 MVA furnace equipment complete with on-load tap changer ready for shipment. The oil conservator and all gauges on the cooler have been removed



On-Load Tap Changing

Until comparatively recently the majority of furnace transformers were supplied at 11 kV or lower voltages, the size of the loads being such that the fluctuating voltage drop on the supply system was acceptable. The present trend towards larger furnace installations with transformers of 10 MVA and above has made it necessary, to avoid undue interference with the supply, to connect these large transformers to the higher capacity 33 or 66 kV systems. The increased duty on circuit-breakers caused by the larger furnaces, the increased voltage on the tapping switches, together with a reassessment of the value of the time lost when changing tappings off-circuit have all contributed to the trend towards the use of on-load tap changing for large equipments.

The duties to be performed by an on-load tap changer on a furnace transformer are more severe than those required with a normal power transformer in respect of both frequency of operation (a figure of 2,500 operations a week may be expected) and larger kVA per tap. For the large tapping range required the voltage between switch contacts is higher than those for a power transformer of equivalent rating. It should be noted that the use of on-load gear precludes the use of the star/delta change-over arrangement. In addition, the switch may be called upon to operate under heavy overload conditions during the melting stage.

Since the function of an on-load tap changer is to enable the secondary voltage of the transformer to be altered without interrupting the load current it follows that, at some time during the sequence of operations, two tappings on the windings must be connected together. The circulating current in the windings during this period is limited by a suitably rated resistor or reactor.

During the past few years considerable development has taken place in tap changers using resistor transition and a high degree of mechanical and electrical reliability has been obtained. The outstanding advantage of using resistors, as opposed to the reactors used previously, is that the need for maintenance of the diverter switch contacts and the oil in the tank containing them is markedly reduced by virtue of the fact that the current broken by the diverter switches is at a high power factor, thus minimising arcing at the contacts.

To ensure that in no circumstances can the tap changer stop with the resistors across two tappings the driving mechanism operates on the "stored energy" principle. Until sufficient energy has been accumulated in the mechanism to complete the whole of the tap-changing operation there is no movement of the current-carrying parts of the switch. As a further safeguard a mechanical follow-up device is incorporated, ensuring that even should the stored energy device fail, a tap change will be completed before the resistors are damaged. The resistors being short-time rated are not very bulky and can conveniently be mounted in either the selector or diverter switch tanks, in contrast to a reactor which would need to be accommodated in the main tank, with a consequent increase in its size.

The construction of the on-load tap changer is similar to that of the off-circuit switch in that it forms a separate unit, bolted to the tank, with the connections to the transformer taken through an insulating terminal board. In addition to the selector switch chamber there is also a separate tank housing the diverter switches. This tank, in which the oil is completely separate from that in either the selector switch or main tanks, is usually fitted with some form of lowering gear to facilitate contact and oil inspection and maintenance. The motor driving mechanism is similar to that used for conventional power transformer applications, and provision is made in the motor compartment to accommodate the switches for remote electrical control and tap position indication.

Alternative Arrangement

When on-load tap changing is employed, it is not possible to use the delta/star change-over arrangement. Consequently, to achieve a secondary voltage variation of 3/1 it would be necessary, with a straight tapped primary winding, to have twice as many turns in the tapping section as in the main winding. Under conditions of maximum l.v. voltage, therefore, the voltage across the switch would be twice that of the supply. This arrangement cannot, in many cases, be considered satisfactory and an alternative method of obtaining the necessary secondary voltage variation has been widely adopted. This, illustrated in Fig. 3, consists of combining in the same tank a tapped auto-transformer regulator to which is connected, via the on-load tap changer, an untapped step-down transformer. Both the regulator and the primary of the step-down transformer are designed for the system voltage, and the l.v. variation is obtained by utilising the tappings on the regulator to reduce the voltage applied to the primary of the step-down transformer. With this arrangement the voltage across the tap switch is limited, under all l.v. voltage conditions, to

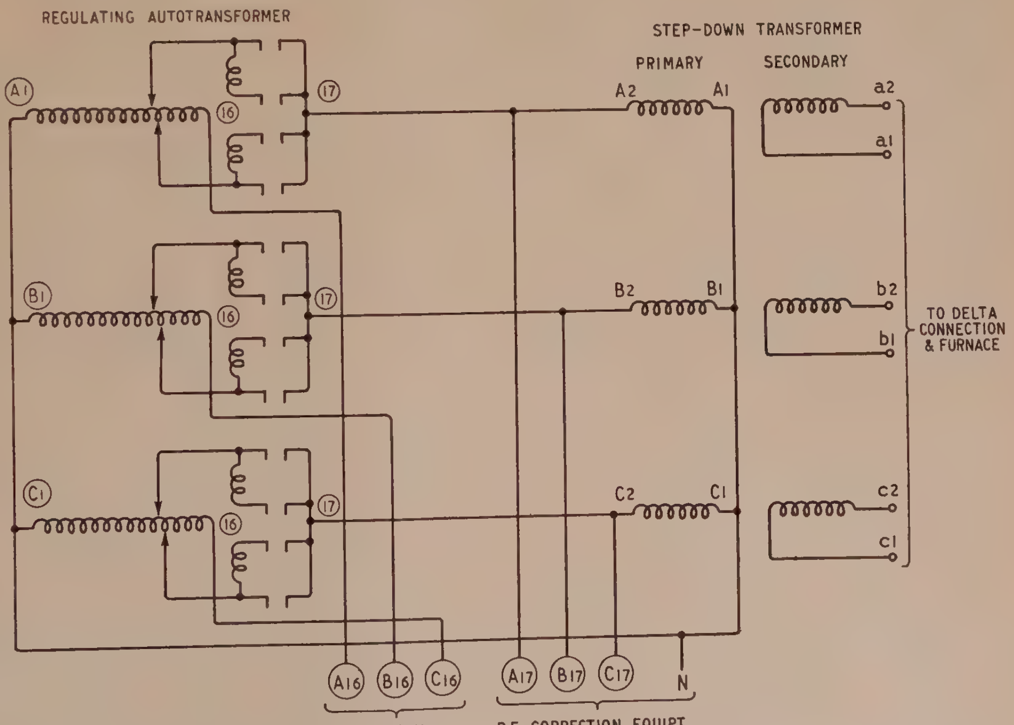


Fig. 3.—Schematic diagram of connections for a furnace transformer with on-load voltage control and power factor correction equipment

some figure equal to, or less than, the system voltage, depending on the tapping in use.

The present-day practice by the supply authorities of basing some proportion of their charges on kVA demand has led to an increased use of capacitors for power factor improvement in furnace equipments. On large installations the power factor, without correction, is unlikely to exceed 0·85 and this can be raised to 0·95 by the connection of suitable capacitors to the primary of the transformer. On smaller installations these can be connected directly across the incoming supply to the transformer but at the lower kVA outputs and reduced secondary voltages, the leading kVAr of the capacitors introduces difficulties of over-compensation which can only be overcome by switching capacitors in or out of circuit as required. On the large equipments where a combined regulating and main transformer is employed, some control of the amount of leading kVAr is possible by connecting the capacitor bank between the main transformer and the regulating transformer, whereby the effective value of the capacitance is progressively reduced with the load kVA. This method of connection, Fig. 3, whilst being the simplest and cheapest from the transformer aspect, necessitates the capacitors being suitable for the supply voltage, which in some cases may not give the most economic overall scheme. An alternative arrangement involving the provision of a tertiary winding of the requisite voltage is, therefore, sometimes adopted.

To minimise the stray loss and reactance drop caused by currents of the order of 30,000 A it is customary to design the l.v. windings for delta connection and to interleave the start and finish leads of each phase winding as far as the delta connection, which is made as close to the furnace as possible. The low-voltage connections, which consist of a number of large section copper straps, must be brought out of the tank through some form of non-magnetic bush. An oil conservator is an advantage and if the conventional type is used, an oil-tight seal must be fitted to each lead where it leaves the tank. Several methods of making these oil-tight joints have proved satisfactory, but they require a certain minimum spacing between the copper bars. There appears to be a trend towards the arrangement shown in Fig. 4 which eliminates the need for oil-tight seals and is more compact. The upper chamber, which is the conservator, is welded to the tank cover and the lower bush through which the l.v. leads pass is sufficiently tight to prevent any air or gas by-passing the Buchholz device into the conservator. The oil level is always below that of the top bush and this, therefore, has only to provide a seal against the ingress of dust or moisture which might run down the bars. If this construction is used on a site with restricted headroom the delta connections and the leads to the furnace may have to be close to the conservator. In such a case the whole structure is made from non-magnetic metal to minimise the effect of the magnetic field due to the heavy currents.

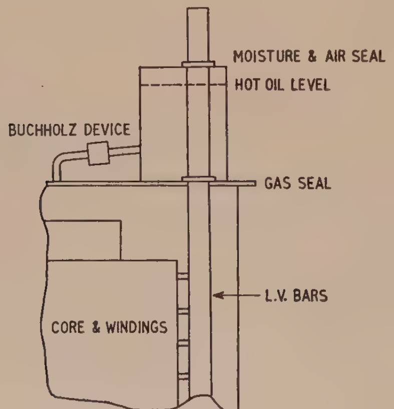


Fig. 4.—Method of bringing out l.v. bars through a conservator

Since the l.v. windings are not solidly earthed at any point it is necessary, to comply with Home Office Regulations, to provide some means of preventing the l.v. winding being raised to the potential of that of the h.v. in the event of an h.v. to l.v. insulation failure. To meet this requirement a static earthing device, which basically consists of two electrodes separated by a thickness of insulation suitable to withstand normal and transient voltage conditions, but insufficient for h.v. line to earth voltage, is connected between one l.v. phase lead and earth.

Cooling

Although, in the past, transformers up to 5 MVA have been supplied with natural (ON) cooling, the present tendency appears to be to utilise the water circuit, which has to be provided for the furnace, to cool most furnace transformers with ratings of 1,500 kVA and above. Equipments with this type of cooling (OFW) are usually provided with one glandless oil circulating pump and an oil-to-water cooler. In some cases, where continuity of supply is absolutely essential during cooler maintenance, a duplicate standby pump and cooler is provided. The pumps and coolers are mounted on the transformer tank to reduce space requirements to the minimum.

To ensure that the cooling equipment is in operation before the supply is switched on to a water-cooled transformer, oil and water flow indicators fitted with switches are incorporated in the main breaker control circuit, and to guard against any contamination of the oil by the water in the cooler, in the event of a leak, the system is so designed that under all conditions the oil pressure in the cooling circuit is higher than that of the water.

Bayonet Cap Lampholders

THE recently published supplement No. 1 to B.S. 52 : 1952, "Bayonet Lamp-caps, Lampholders and Lampholder Plugs," applies solely to B.22 bayonet cap lampholders made of insulating material and suitable for tungsten filament lamps used for general lighting service. It is intended to ensure interchangeability of parts, particularly of the shade carrier rings. A protective shield can be used instead of a shade carrier ring when required. Moulded insulated lampholders are subject to shrinkage as a result of heating during service, and this shrinkage is not constant with any one design. The dimensions and tolerances for screw threads specified in the supplement result from a comprehensive programme of tests and will provide for variations in manufacture and for dimensional changes during the life of the shade carrier ring.

Suitable tests to ensure satisfactory quality of design and manufacture are included, since B.S. 52 is mainly a dimensional standard. Although the tests are for lampholders specified in the supplement, any B.22 lampholders of moulded insulated material complying with B.S. 52 should also be capable of passing them. Since the new designs are a radical departure from many existing types, their production will call for major changes in manufacture, including the replacement of moulding tools and, to allow time for the necessary changes to be made, the new supplement will not come into force for at least two years.

Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 5s.

Durgapur Steelworks

Inauguration of Large Indian Project

ON 29th December the first blast furnace to be installed at the Durgapur steelworks, West Bengal, was officially inaugurated by Dr. Prasad, President of India. This steelworks represents the largest single export order ever obtained by Great Britain. The contract is worth £105 million and is being carried out for Hindustan Steel, Ltd., by the Indian Steelworks Construction Co., Ltd. (ISCON), a consortium formed specially for the purpose. The thirteen companies making up this consortium are: Davy & United Engineering Co., Ltd., Head, Wrightson & Co., Ltd., Simon-Carves, Ltd., Wellman Smith Owen Engineering Corp., Ltd., Cementation Co., Ltd., British Thomson-Houston Co., Ltd., English Electric Co., Ltd., General Electric Co., Ltd., Metropolitan-Vickers Electrical Co., Ltd., Sir William Arrol & Co., Ltd., Cleveland Bridge & Engineering Co., Ltd., Dorman, Long (Bridge & Engineering), Ltd., and Joseph Parks & Son, Ltd.

Last week's ceremony marked the inauguration of an integrated steelworks and not just the completion of one blast furnace. Durgapur is a joint Indian/British effort and about 50 per cent of the capital expenditure and tonnage of raw materials has been supplied by India herself. Most of the 33,000-strong labour force on site are Indian, including a high proportion of skilled Indian supervision. The number of British technicians working at Durgapur is under 400. To provide for the operation of the steelworks 350 Indian technicians are being trained through the Colombo Plan in the United Kingdom and others elsewhere. In addition, the British Iron and Steel Federation has seconded technicians from this country to assist in the initial operation of the plant and to complete the training of the Indian technicians.

Provision for Doubling Output

The Durgapur plant is situated about 120 miles from Calcutta and occupies an area of 1,500 acres. The plant will be capable of an annual output of 1,000,000 ingot tons of steel, but the layout of the works has been so arranged as to enable the various production departments to be further extended to achieve an output of at least 2½ million ingot tons.

The electrical equipment being installed at Durgapur includes 3,500 electric motors with an aggregate rating of 146,000 h.p. embracing many types and sizes ranging from the large 7,000 h.p. motor driving the billet mill to those of fractional h.p. used for small tools, fans and the like. In addition, there are some 18 MW of rectifiers and some 22 MW of motor-generators. The lighting installation alone has a loading of 7 MW. The communication system includes a 500-line automatic telephone exchange and more than 100 special telephones and signal and radio-telephone equipment.

The importance of an adequate and reliable supply of electricity to such a works is obvious. Durgapur is connected to the local grid system whose operators, the Damodar Valley Corporation, are engaged in building a 150 MW coal- and gas-fired power station close to the steelworks. When the Durgapur plant is complete it will have an electrical loading of 50 MW. Four separate underground cables will carry power into the works from the local network at 33 kV, but any three of these cables will carry a full load.

No. 1 blast furnace at Durgapur steelworks, India

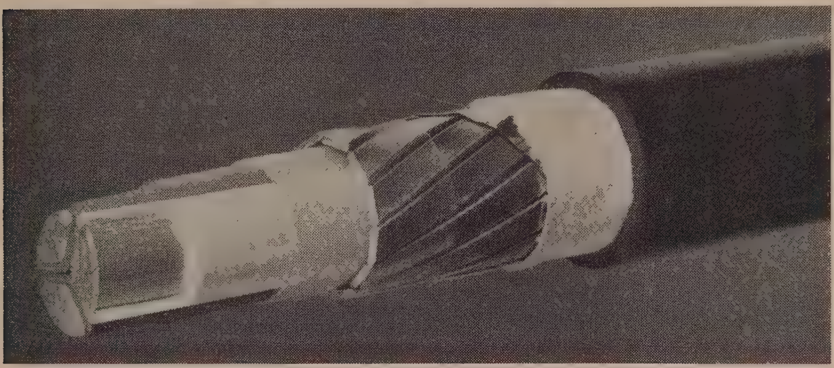
The works have been equipped with three turbo-generator sets, each of 5 MW capacity, to make provision for safeguarding some of the most vital plant. The failure of the outside supply would merely bring plant such as the rolling mills to rest, but the furnaces, which depend for their safe operation on a continuous supply of electrically pumped water, would be severely damaged if an electricity failure cut off the water supply for only a few minutes. The turbo-generator sets will operate continuously and will provide sufficient power for maintaining vital supplies of water and keeping the coke ovens, blast furnaces and melting shop in full operation. These generators will normally be run in parallel with the outside supply and will deliver an electrical load depending on the steam available, but if the outside supply should fail they will not only continue undisturbed but will automatically take up the load required by all the vital plant.

The work of building the Durgapur plant is being undertaken in four stages with a final target date of 31st July, 1961. The first stage, which is now complete, includes the first coke oven battery, one blast furnace, foundry and pattern shop, and the central engineering maintenance shop. The second stage should be completed by the end of April next. This involves the second coke oven battery, benzol rectification plant, the second blast furnace, a steel melting shop with three open hearth furnaces, a 42in blooming mill, a continuous billet mill, sleeper bar plant and an oxygen plant. The third stage will take a year to complete and will include another coke oven battery and blast furnace, four more open hearth furnaces, a 24in medium section mill and a continuous merchant mill. The fourth and final stage of the work will take three months and during this time the remainder of the steel melting shop will be built and a special casting shop and wheel and axle plant will be constructed.

ALUMINIUM CORED-CABLE

AN electric power cable having shaped aluminium conductors with p.v.c. insulation and available in ratings up to 400 A and 1,100 V has been designed and developed by the Northern Aluminium Co., Ltd., of Banbury, and Aluminium Laboratories, Ltd., both member companies of Aluminium, Ltd., of Canada. It is claimed that the cable is easy to lay and joint and offers appreciable savings in manufacturing cost.

The design of "Solidal" cable is based on solid shaped conductors of fully-soft aluminium. Each sector-shaped core is insulated by an extruded p.v.c. coating, and the conductors are laid up with a right-hand lay. Pre-twisting of the conductors has not been found necessary. The laid-up conductors are lapped with a clear p.v.c. tape to a thickness of 0·04in. Outside this is a single layer of rectangular hard aluminium wires applied with a left-hand lay, their total cross-sectional area being equal to that of one of the cores. These wires give mechanical protection to the cores and provide a low-resistance screen to prevent electrical leakage in the event of severe damage. They are also designed to serve as the neutral conductor, and the cable is economically attractive when used as a three-core cable with concentric neutral. A four-core version with electrically separate armour is, however, being developed.



The "Solidal" cable incorporates solid aluminium cores and concentric neutral/armour wires

Over the neutral/armour wires may be laid a right-hand-lay tape of 0·005in aluminium foil, to equalise current distribution in the wires. This, required by certain Continental specifications, ensures a low-resistance path for any fault current that may be flowing to any one of the wires, and averts the danger of the wires being insulated one from the other by inward penetration of the outer sheath. A barium-chromate linen tape may be wound over the current-equalising tape to protect the wires against chemical attack by soil electrolyte in the event of the outer sheath becoming damaged during installation. Owing to the robustness of the sheath, this is unlikely, and in areas where conditions are known to be non-aggressive, the tape may be omitted. A sheath of black p.v.c. is extruded overall. The thickness of both insulating and sheathing plastic is in accordance with normal design standards for 1,100 V cables.

Electrical-purity aluminium costs at present only some 30 per cent as much as electrical copper on a volume basis and, even allowing for the somewhat larger cross-sectional area dictated by the lower conductivity of aluminium, the cost of an aluminium conductor is about half that of its electrical equivalent in copper. Since the cable fabrication cost is nearly the same for either conductor metal, much of this saving remains in the finished cable. The low density of aluminium—less than one-third that of copper—results in a lightweight cable easy to handle and requiring fewer supports for above-ground installation. A 40ft coil of 200 A "Solidal" cable weighs little more than 50 lb. It meets the requirements of the bending tests specified for insulated cables, being bent to small radii and re-straightened with acceptably low forces because the conductor metal is soft and the overall size of the cable is small.

Six sizes of three-core cable with concentric neutral were initially made, chosen to have current ratings of 100, 150, 200, 250, 300 and 400 A when laid direct in the ground. The 100 A rating had a cross-sectional area of 0·0413 sq in and a maximum resistance at 20°C of 1·0105 Ω/1,000 yd, the corresponding figures for the 400 A size being 0·471 sq in and 0·08861 Ω/1,000 yd. A concentric single-phase service cable was also made, consisting of a solid round centre core, with p.v.c. insulation, surrounded by round wires forming the neutral. This was rated at 75 A and had a cross-sectional area of 0·026 sq in and a maximum resistance of 1·5870 Ω/1,000 yd at 20°C. "Solidal" is now being made with nominal cross-sectional areas of 0·04, 0·06, 0·1, 0·15, 0·20, 0·25, 0·30, 0·40 and 0·50 sq in and corresponding maximum resistances at 20°C of 1·062, 0·7015, 0·4171, 0·2848, 0·2143, 0·1707, 0·1391, 0·1035 and 0·08442 Ω/1,000 yd.

Jointing by soldering is quicker than with stranded cables, where penetration between the strands has to be ensured. Solders, and fluxes where necessary, can be supplied by Fry's Metal Foundry, Ltd., W. T. Glover & Co., Ltd., Grey & Marten, Ltd., and Unifluxes (London), Ltd. A compression jointing technique, which dispenses with the need for any heating, is being developed, and the fittings required can be supplied, subject to inquiry. The Northern Aluminium Co., Ltd., does not make or sell the cable, but supplies the conductor cores to cable manufacturers. Companies who are making or are prepared to make this cable are Aberdare Cables, Ltd., B.I.C.C., Ltd., Crompton Parkinson, Ltd., W. T. Glover & Co., Ltd., the Hackbridge Cable Co., Ltd., W. T. Henley's Telegraph Works Co., Ltd., Pirelli-General Cable Works, Ltd., Siemens Edison Swan, Ltd., Standard Telephones & Cables, Ltd., the Sterling Cable Co., Ltd., and the Wandleside Cable Works, Ltd.

U.S.-Euratom Joint Research

The United States-Euratom Joint Research and Development Board announced last week that 23 contracts for research and development work totalling approximately $3·5 million have been authorised within the Community and the United States during the past six months. The Board has concentrated its efforts chiefly on proposals related to the nuclear fuel cycle, and approximately half the funds have been awarded to fourteen Community and half to eight U.S. industrial groups.

New Methods of Observing Commutation and Measuring Self-Inductance

Summaries of two papers read before the Measurement, Supply and Utilisation Sections of the Institution of Electrical Engineers on 5th January. The first paper by H. J. H. Sketch, B.Sc.(Eng.), A.M.I.E.E., P. A. Shaw, B.Sc.(Eng.) and R. J. K. Splatt is entitled "A New Method for Observing the Phenomena of Commutation." The authors of the second paper, entitled "A Method of Measuring Self-Inductance Applicable to Large Electrical Machines," are Prof. J. C. Prescott, D.Eng., M.I.E.E., and A. K. El-Kharashi, Ph.D.

The first paper describes a new method of measuring the armature coil current in a d.c. machine as it reverses during commutation. A small search coil fixed relative to the armature was arranged to be magnetically coupled to one of the armature coils. The e.m.f. induced in the search coil, which is proportional to the rate of change of armature coil current, was applied to a pair of slip-rings temporarily secured to the armature shaft. A simple integrating circuit, connected between brushes, enabled the variation of armature coil current to be examined on an oscillograph.

The search coil consisted of a small air-cored toroidal winding, supported from the armature shaft by a resin-bonded fabric clamp. One armature coil was broken, and the connection was remade with a short length of copper wire linking the toroid. A search coil of toroidal form was chosen to ensure that the e.m.f. induced was predominantly due to the magnetic field associated with the selected armature coil. The armature shaft was hollow as far as the back overhang, and a small hole drilled in the shaft at this position enabled connecting leads to be taken to the commutator end of the armature, where an existing internal thread was used to mount a specially made extension shaft carrying the slip rings. These were made of stainless steel and the brushes were of silver graphite. The integrating circuit was simply a resistor and capacitor in series.

The paper then describes a method of triggering the oscillograph time-base which permitted examination of the current reversals as they occurred in a number of consecutive revolutions of the machine. The machine was found to run at 5,000 r.p.m. with a load of 100 A without sparking, and the equivalent main interpole current could be varied by 3·75 A on either side of the normal value before sparking was observed. Oscillograms of armature coil current and the rate of change of that current were then taken with larger alterations in the interpole excitation at the same speed and load. These showed irregularities in the current trace compared with the oscillogram taken with the best adjustment of the interpole excitation. This was explained by the authors as follows: At any one instant in time there are several coils undergoing commutation which are at different stages in the process. If the interpole field is bucked or boosted, it is reasonable to suppose, from symmetry, that all armature coils have their current reversals retarded or accelerated in a similar manner. Thus, at some instants while the current is being reversed in the coil containing the measuring apparatus, other coils will complete commutation with a high rate of change of current, and this will affect the coil current measured.

When the machine was run at 10,000 r.p.m. with a load of 200 A, severe sparking was observed at the commutator which could not be removed by adjusting the interpole excitation. This condition was accompanied by some instability in the shape of the coil-current oscillograms which was due to intermittent contact between the brushes and commutator. The differences in shape from revolution to revolution were attributed by the authors to the non-cyclic behaviour of the intermittent contact.

To obtain better contact between brushes and commutator at high speed, a special set of brushgear was made for experimental purposes. Since the brush restoring force could not be significantly increased without overheating the commutator, efforts were made to reduce the effective mass of the brush and restoring device in motion. This resulted in oscillograms with very little change in shape from one revolution to the next.

Measurement of Self-Inductance

The second paper describes a method of measuring the self-inductances in large electrical machines. A fluxmeter connected into a bridge network is found to provide a convenient method of measuring self-inductance especially where circuits of high inductance which carry heavy currents are concerned. The bridge circuit is shown in Fig. 1. Here, F is the fluxmeter, which can be short-circuited by moving the switch S$_2$ to (a), and will have a resistance of about 15 ohms. R$_C$ and R$_C'$ are two equal low resistances (ammeter shunts can conveniently be used) while A is the coil whose inductance is to be measured and R$_B$ is a non-inductive resistance. The ammeter M measures the current supplied to A from the battery B. This current can be regulated by the resistance R and interrupted by the switch S$_1$. The switch J is provided for calibration purposes and may be regarded, for the moment, as being closed. With S$_1$ closed and

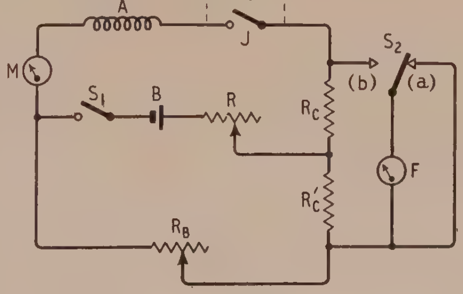


Fig. 1.—Bridge circuit for measuring the apparent self-inductance of a coil as a function of time

with S_2 on (b) the bridge can be brought into a state of balance, as indicated by the fluxmeter pointer becoming stationary, if the value of R_B is suitably adjusted. The current Io in A is now read on M and the switch S_1 is opened. The opening of S_1 puts the bridge out of balance due to the inductive e.m.f. generated in A and the fluxmeter will be suddenly deflected through an angle θ (say). This throw is directly proportional to the number of volt-seconds generated in A so we have $K\theta = \frac{1}{10^8}\int \frac{d\Phi}{dt}dt = \frac{\Phi}{10^8}$ where Φ is the total change in flux linkage associated with the change of current, Io to zero, and K is a constant; but the co-efficient of self-inductance may be defined as $L = \frac{\Phi}{10^8 Io}$ thus $L = \frac{K\theta}{Io}$.

It remains to determine to value of K. Remembering that the throw θ is directly proportional to the number of volt-seconds generated by the coil A, it is seen that if A is replaced by a non-inductive resistance whose ohmic value is equal to that of A and if with the switches S_1 and J open, a small voltage v, from the source shown dotted, is applied across J for a given time t′ seconds and if the resulting fluxmeter throw is θ', then $vt' = K\theta'$; $K = \frac{vt'}{\theta'}$ and $L = \frac{vt'\,\theta}{Io\,\theta'}$.

Since the calibrated fluxmeter measures the total change in flux linkage which occurs while it is connected in the bridge circuit, it is possible, if suitable switching arrangements are provided, to investigate the manner in which the flux linkage varies with time and thus to determine the average value of the coefficient of self-inductance over given time intervals.

If the switch S_2 remains on (a) till a given interval t has elapsed after the opening of S_1 and is then moved instantaneously to (b), the throw of the fluxmeter will measure the change of flux linkage occurring between the time t and the time when the current has fallen to zero. By giving t the values $t = 0, t_1, t_2$, etc., and arranging that the initial current Io is the same for each, we may obtain from a series of tests the curve of Fig. 2 giving the relation between flux linkage and time. To assess the average self-inductance L_1, over the interval $0 - t_1$, we write:

$$L_1 = \frac{\Delta\Phi}{\Delta I} = \frac{\Phi o - \Phi_1}{Io - I_1}$$

Φo is the change in flux linkage for a current change $Io \rightarrow 0$ and Φ_1 is the corresponding quantity for a current change $I_1 \rightarrow 0$. We know the values of Φo, Φ_1 and Io: we require the value of I_1, the current corresponding to Φ_1. Remembering that the switch S_1 is open while the current is changing and that the resistance of the fluxmeter is very large compared with R_C and R_C' we have

$$I_1 = \frac{-1}{10^8(R_C + R_C' + R_A + R_B)}\left(\frac{d\Phi}{dt}\right)_{t = t_1}$$

but $\left(\frac{d\Phi}{dt}\right)_{t = t_1}$ is the slope of the curve at t_1 (= tan a), and its value may be obtained by drawing the tangent.

Proceeding in this manner, it is possible in the case of a synchronous machine to determine the sub-transient, transient and synchronous reactance from a series of static tests and, if sources of large direct currents are available, the measurements can be made under conditions of saturation which simulate closely the conditions obtaining when the machine is on load.

It is interesting to notice that the bridge network of Fig. 1 is that associated with the names of Maxwell and Rayleigh who used a ballistic galvanometer as their indicating instrument, and that Mr. C. V. Jones had applied the bridge and ballistic galvanometer to the measurement of machine self-inductances* before the publication of their paper by Prescott and El-Kharashi.

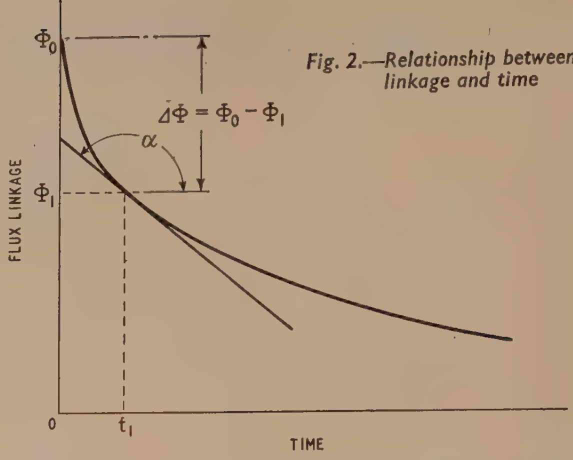


Fig. 2.—Relationship between flux linkage and time

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* Jones, C. V. An Analysis of Commutation for the Unified-Machine Theory. *Proc. I.E.E.* Monograph No. 302 U. April, 1958.

Diamond Jubilee of I.E.E. Centres

THE North-Eastern Centre of the Institution of Electrical Engineers recently held a special meeting at Newcastle-on-Tyne to mark its diamond jubilee. Sir Willis Jackson, President of the I.E.E., who attended, was presented by the Centre with an attendance register desk made by Tyneside craftsmen to the design of Mr. L. C. Evetts, Master of Design, King's College, Newcastle. The desk will stand at the entrance to the main lecture theatre of the I.E.E. in London. Sir Willis said that the membership of the Centre had grown in sixty years from 72 to more than 1,600, and it had provided seven presidents. Mr. J. R. Beard, who was chairman of the Centre forty years ago, gave the jubilee address, and referred to the work of such local inventors as Sir Charles A. Parsons and George Stephenson.

To celebrate the diamond jubilee of the Scottish Centre of the Institution of Electrical Engineers, a conversazione has been arranged to take place in the Bute Hall of the Glasgow University on 28th January (7.30 for 8 p.m.). At the function, the signature desk, to which members of the Scottish Centre have subscribed, will be presented by Mr. J. A. Aked, the Centre chairman, to Sir Willis Jackson, the President, who will receive it on behalf of the Institution. Members and their ladies may attend and applications for tickets (12s 6d each for members and 7s each for graduates and students) should be made by 22nd January to Mr. J. H. P. de Villiers, hon. secretary of the Scottish Centre, c/o Bruce Peebles & Co., Ltd., Edinburgh, 5.

Terminal Markings

OWING to the wide range of terminal markings covered by the 1938 edition of B.S. 822, "Terminal Markings for Electrical Machinery and Apparatus," and with the intention of including further terminal markings in a revision of the standard, the new edition is being published in a series of parts designed to fit into a binder. Four parts have already been published and Part 5, now available, gives the markings for the input terminals of composite apparatus, i.e. apparatus comprising different components which are permanently mounted and wired together. The markings are also generally applicable for the input terminals of apparatus not the subject of a British Standard. Copies may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 3s.

Kariba Hydro-Electric Scheme

100 MW SET IN OPERATION

View of Kariba Dam with the switching station on the high ground beyond

When completed, the Kariba hydro-electric scheme on the Zambesi River in Rhodesia will have a capacity of at least 1,500 MW. Initially, only part of the project is being undertaken and the first stage consists of a dam, a diversion tunnel and an underground power station. This power station will house six 100 MW turbo-generators. The final stage will consist of a second underground power station with a capacity of 800 to 1,000 MW on the other bank of the Zambesi. Half the cost of the final stage is expected to be met out of revenue from the initial stage.

The Kariba Dam will create a reservoir 175 miles long and, in places, 40 miles wide and will have an area of approximately 2,000 sq miles. Although the natural flow of the Zambesi has wide seasonal variations, the capacity of the reservoir will give sufficient storage for the ultimate capacity of the combined power stations which will then have an estimated annual output of over 9,000 million kWh.

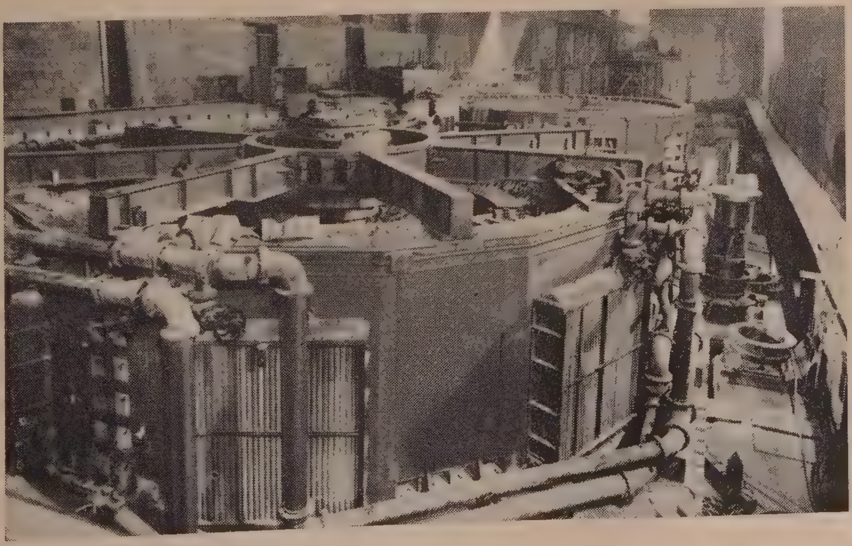
The first of the six 100 MW generators, which are being supplied by Associated Electrical Industries, Ltd., Heavy Plant Division, Manchester, commenced to supply power to the Northern Rhodesia Copperbelt on 28th December. The second generator is due to go into service on 1st May next and a third generator towards the end of the year; two more generators will be commissioned in 1961 and the sixth machine in 1962. Each of these generators weighs 720 tons, is 40ft in diameter and will be coupled to a Francis type turbine made by Boving & Co., Ltd. The generators are rated at 100 MW, 0·9 power factor lagging, 18 kV, 50 c/s, and operate at a speed of 166·7 r.p.m. The vertical shaft is fitted with a thrust bearing and one guide bearing is positioned immediately below the rotor. Excitation is provided by a 364 kW, 360 V, d.c. machine fitted to the generator and controlled by a rotating magnetic amplifier type voltage regulator.

The generators will be connected to three 240 MVA three-phase transformer banks, each comprising three single-phase 80 MVA, 18/330 kV, OFW transformers. Ten of these transformers (one spare) are being supplied by the English Electric Co., Ltd., and they will be housed in the underground power station.

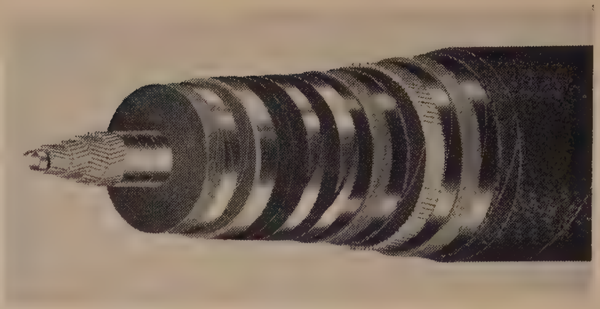
Power is transmitted from Kariba at 330 kV, and the 330 kV switchgear is being supplied by the A.E.I. Switchgear Division, Willesden. This switchgear comprises 25 circuit-breakers for seven substations and more than 100 isolators. The 330 kV circuit-breakers have a breaking capacity of 750 MVA and are of the bulk oil lenticular tank type.

The 330 kV main cables, which are being supplied by British Insulated Callender's Cables, Ltd., are of the oil-filled type. From the terminals of the transformers situated in the underground transformer hall, the cables travel in sand-filled troughs through a horizontal tunnel for approximately 240ft before rising up a 540ft vertical shaft. The remainder of the route is in steeply-rising ground terminating at the switching station.

Each single-core cable has a conductor area of 0·85 sq in of copper, rated at 500 A and consists of a central spiral steel duct surrounded by layers of copper wires of the required section. The conductor is lapped with three metallised paper screening tapes, followed by graded thickness insulating paper tapes to a wall thickness of approximately 1·1in radial. The dielectric is finally screened by one metallised paper and one copper



Power station machine room



Stepped sample of B.I.C.C. 330 kV cable

woven fabric tape. A lead alloy sheath reinforced with tin-bronze tapes and armoured with hard-drawn aluminium wires protects the dielectric and forms the pressure-retaining wall of the cable.

The cable sealing ends are of the condenser cone type having hand-applied paper rolls housed in outdoor porcelains. A particular feature of the condenser cone is that the build-up of paper rolls and foils is capable of withstanding the full hydrostatic pressure in the event of a porcelain being accidentally damaged. Since Kariba is in an area of very severe lightning incidence, this has necessitated an impulse test withstand level of 1·5 MV on cables and accessories.

To utilise the power transmitted from Kariba, substations are being built at Kitwe, Norton, Salisbury, Sherwood, Bulawayo and Lusaka. Ferranti, Ltd., are supplying two 120 MVA, 330/234 kV, three-phase auto-transformers with separate boosters, eight 60 MVA, 330/88 kV, and two 60 MVA, 330/33 kV, three-phase double-wound transformers. Two 60 MVA 220/72·6 kV three-phase transformers are also being supplied by the English Electric Co., Ltd., for these substations.

The electrical and mechanical consulting engineers for the Kariba project are Messrs. Merz & McLellan.

ELECTRICAL ACCIDENTS

SOME safety aspects of recent developments in the electricity supply industry are discussed in the " Report on Electrical Accidents and their Causes, 1958," produced by H.M. Factory Inspectorate of the Ministry of Labour and published by H.M. Stationery Office, price 5s.

Fire risks in electrical substations, and in using floor and night storage heating, are also among the subjects covered and there are sections on the use of limit switches and interlocks, accidents from overhead electric lines, earth fault loop impedance testing, small portable fluorescent lamps and earthed concentric wiring. An appendix gives recommendations for electrical apparatus used in aircraft maintenance hangars.

An analysis of the electrical accidents reported under the Factories Acts showed that the decrease between 1955 and 1957 was not maintained, the total number rising from 687 in 1957 to 714, of which 38 were fatal and 127 were welders' conjunctivitis or " eye flash." In addition to the 38 reported fatalities, a further 125 fatal accidents came unofficially to the notice of the Inspectorate, the total being 163 compared with 135 for 1957. Of the 38 reported fatalities, 20 were caused by voltages up to 250 V, six by voltages between 251 and 650, one between 651 and 5,000 V, seven from 5,001 to 10,000 V and four at voltages over 10,000.

APPARATUS INVOLVED IN REPORTABLE ACCIDENTS

Apparatus	Fatal	Non-Fatal
PORTABLE AND TRANSPORTABLE APPARATUS:		
Hand tools	10	62
Heaters and irons	—	2
Lamps	1	14
Testing sets, including lamps, instruments, etc. ...	—	23
Plugs, sockets, couplings and adaptors	2	25
Cables and flex for portables	1	20
Electric hand welding: Shock and burn only	—	24
Eye-flash	—	127
FIXED APPARATUS:		
Rotating machines	—	6
Transformers and reactors	—	5
Switchgear above 650 V	3	44
Switchgear below 650 V	—	133
Fusegear	2	27
Crane and other trolley wires, etc.	8	18
Lamps	—	18
Cables and accessories excluding those for portable apparatus	2	78
Test leads, test terminals, etc.	—	14
Overhead transmission and distribution lines:		
(*a*) Contact by cranes or similar machines	8	6
(*b*) Direct contact by persons or materials and tools	1	3
Apparatus not classified	—	27
TOTAL ...	38	676

An investigation of accidents involving electric shocks from portable apparatus showed that four (one fatal) were due to faults in the socket or its supply wiring, 28 (three fatal) occurred when the fault was in a plug, adaptor or coupling, 18 (four fatal) were due to faults in the cable or flexible lead to the apparatus and 25 (two fatal) happened as a result of faults in the apparatus itself. Twenty-three accidents were associated with the use of portable testing apparatus and 14 with other test leads and terminals. Of the total of 56 accidents associated with testing in some form, only 22 occurred to testing staff. The majority injured were electricians tracing faults during normal maintenance work.

The number of accidents involving electric shock, with or without burns, was 316, and the number involving burns, with or without shock, was 424, while the number involving shock and burns together was 161. Of the 316 persons receiving shock, 53 became unconscious and all but four received artificial respiration. Of these, 26 died and 23 recovered, while the four who were not given artificial respiration also died.

Submarine Cable Laying

THE provision of long transoceanic telephone cables has been made possible by the development of the submarine repeater, but new techniques have had to be devised for the laying and repairing of submarine coaxial cables of both conventional and unarmoured types incorporating either flexible or rigid repeaters. In a lecture entitled " The Laying of Submarine Cables," prepared by Captain W. H. Leech and given to the Electronics and Communications Section of the Institution of Electrical Engineers recently, some of the new equipment and techniques were described.

The last ship built primarily for laying submarine cable, commissioned in 1946, was H.M.T.S. *Monarch,* equipped with 3ft 6in bow sheaves and cable drums less than 6ft in diameter. Extensive modifications to the cable working arrangements had to be carried out to permit the laying of both flexible and rigid repeaters. A new ship, No. 801, is now being built for the Post Office, incorporating the latest loading, stowage and laying arrangements for cables with repeaters. Fault location in repeatered cables and deep-water repairs to cables with flexible repeaters were also described.

Electricity Supply Apprenticeships

VIEWS OF THE ELECTRICAL POWER ENGINEERS' ASSOCIATION

IN a statement issued last Friday, the Electrical Power Engineers' Association suggested that the Electricity Council should ask the Institution of Electrical Engineers to look again at its entry requirements with a view to making these less exacting. The report also shows that in the past five years the number of graduate trainees entering the electricity supply industry annually has fallen from 143 to 42 while the number of student apprentices has increased over the past four years from 1,500 to 2,124 yearly.

The Association considers that the reduced number of graduate trainees entering the industry in recent years is due partly to the relatively unattractive rewards and opportunities in the electricity supply industry. The total number of university graduates included in the figures of graduate trainees in the four recruiting years to 1958 was eight, seven, nine and five respectively. This is hardly considered to be a superfluity in relation to the total technical staff of the industry of approximately 16,000. A new approach to the recruitment of graduate engineers is considered to be necessary. It is suggested that the industry should follow the example of large private firms and recruit graduate material from grammar and public schools before the university stage. It is intended that headmasters would be asked to forward applications from pupils with three advanced level G.C.E. passes to the Central Electricity Generating Board or Area Electricity Boards with a confidential report. Those selected would be offered a scholarship of £400 per annum to enable them to read for honours degrees.

SOURCES OF RECRUITMENT—ELECTRICITY SUPPLY INDUSTRY

	Per cent
Graduate trainees and student apprentices (entrant training schemes)	26
Promotion from manual grades	35
From outside electricity supply industry	39
	100

The main source of new technical staff in the supply industry is the student apprenticeship. The arrangement whereby the apprentice was expected to obtain his theoretical knowledge by part-time attendance at a technical college is now being modified by schemes for sandwich courses. The inauguration of the Diploma in Technology (Dip.Tech.) is accelerating this development, but even so only about one-quarter of the total requirement for technical staff in the supply industry is being provided by these training schemes (see table).

Ideally, every student engineer should obtain the Dip.Tech. but, since only a minority are likely to do so, the Higher National Certificate will probably remain the qualification within the reach of many student apprentices. It is therefore unfortunate that the Institution of Electrical Engineers should have so tightened its regulations that the way to corporate membership via the H.N.C. route is now very narrow. When raising the standards required for membership, the I.E.E. argued that those who could not fulfil the new requirements must regard themselves as technicians. The E.P.E.A. thinks that the result will be that many young engineers will fail to surmount the new steeper grade and will continue to do the work of staff engineers without professional recognition.

The estimated required increase in the number of professional electrical engineers by 1959 should be approximately 30 per cent of the 1956 figure, but over the past 25 years the average rate of growth of corporate membership of the I.E.E. has been 4·5 per cent per annum. Many eminent engineers in the supply industry qualified via the H.N.C. route, yet the I.E.E. now rejects such men, presumably as unfit to be regarded as professional engineers. The Association suggests that, while the intentions of the I.E.E. were of the best, the methods of application have unfortunately paid little attention to reality. The E.P.E.A. therefore suggests that the Electricity Council should ask the I.E.E. to reconsider its new entry requirements.

For the future, the Association suggests that there should be three student training courses: generation specialisation, distribution specialisation and a general course without specialisation. The third course would be an innovation for those who prefer to be trained broadly in the electricity supply business with special emphasis on trading and commercial relationships.

The table shows that nearly 40 per cent of recruits are from outside the supply industry. The Association sees no objection to this and considers that too much " mental inbreeding " is bad for any industry. It also considers that adult training for engineers should be expanded.

Power Engineers' Salaries

With regard to the rewards of the power engineers, the Association concludes that, while money is not the sole attraction to would-be engineers, they tend to prefer employment which has a definite minimum salary prospect. At present, the only automatic progression to which the electricity supply entrants can look forward is £700/annum after several years. There is a need, therefore, to establish an improved salary progression for entrants, and this the E.P.E.A. thinks would have a marked effect in improving the quality of those recruited.

This statement on education and training was prepared by the E.P.E.A.'s Technical Education Sub-Committee and approved by the National Executive Council. Members of the sub-committee are:—Messrs. H. J. Fraser, M.I.E.E. (chairman), F. A. Geary, M.I.E.E., S. C. Howton, F. H. Last, Ph.D., B.Sc., A.M.I.E.E., R. M. Lee, M.I.E.E., J. L. Moss, A.M.I.E.E., and A. M. F. Palmer, A.M.I.E.E., M.Inst.F. (secretary).

Consulting Engineers

AN illustrated 100-page brochure giving details of some of the works in which British consultants are engaged has been prepared by the Association of Consulting Engineers, Abbey House, 2, Victoria Street, London, S.W.1. Information on major engineering works, including the consultants, contractors and estimated cost, in some seventy countries is given, divided into the work in hand at the beginning of 1959 or completed in 1958, and schemes in the preliminary stages of investigation and report. This summary covers such subjects as airports, electrical services, railways, thermal and hydro-electric power stations and transmission systems. In addition, there is a brief note outlining the advantages of employing consulting engineers.

Engineering in Europe

A COMPARISON of the operating characteristics and efficiencies of germanium, silicon and selenium rectifiers seems to favour the first two types of semiconductor rectifiers, if only maximum outputs under most favourable operating conditions (rarely achieved in practice) are considered. While their very small specific volume is emphasised, however, less mention is made of the relative unreliability of these types, particularly germanium diodes, when working under high loadings and the optimum temperature of the transition layer is exceeded even if only for a very short time. The effect is destruction of the diode.

The same thing applies to silicon rectifiers, but to a slightly lesser extent. A great advantage of selenium rectifiers is that they are less sensitive in this respect and that if punctures occur they are mostly self-healing. If they are to successfully compete with germanium and silicon rectifiers, the author suggests, the differential resistance of the plates should be reduced to 1/10 of its present value of 1·1 ohm/cm^2; additional losses could be reduced by forced cooling. The specific volume of the selenium rectifiers would be then reduced to the same level as that of germanium rectifiers.—" Possibility of Rendering Selenium Rectifiers Competitive with Germanium and Silicon Rectifiers," J. Kroczek, *Elektrotechn. Obzor*, Vol. 48, No. 10, pp. 507-510, October, 1959, in Czech.

Current Transformers

Relationships are derived for the secondary current of current transformers when their primary winding absorbs high overcurrent, for example, during short-circuits in a power system. Since such calculations were not formerly possible, the theory presented fills, at least partly, a gap which will only have to be corroborated by experimental results. Now, at least, the German regulations require that the amplitude factor of the currents of such transformers be limited to $n<5$, if they are connected to measuring instruments or protective devices. This involves a much higher price for the special core materials, for example " Mumetal," as against the usual silicon-iron cores but, in addition, the low-saturation core materials will not contribute to an appreciable reduction of the overcurrents either. This is explained by the fact that the thermal and mechanical stresses of the secondary circuit depend mainly on the burden and its power factor, and the required limitation of the overcurrents must be achieved by a correct adjustment, or layout, of the burden.—" Secondary Currents of Current Transformers under Sudden Short-Circuit Stresses," H. F. Vogel, *Elektrotech. Z. (E.T.Z.) A.*, Vol. 80, No. 19, pp. 665-671, October, 1959, in German.

Rotary Amplifiers

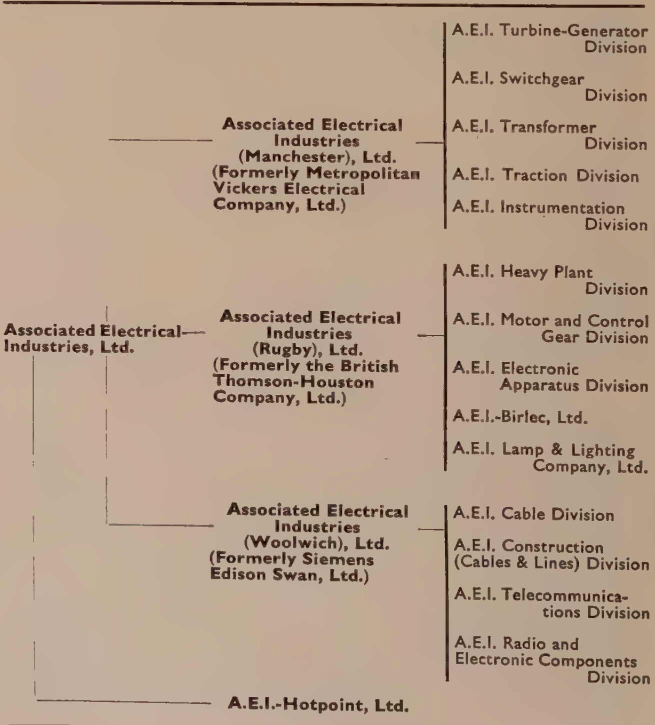
Modern automatic control circuits often incorporate direct-field rotary amplifiers, particularly where large outputs are required. They are also used as main exciters in large automatic control systems. The design of these machines may be based on that of normal large d.c. machines, with a utilisation factor of 0·3 to 0·5 of the normal rating of the size, at the same speeds. The power amplification of a three-stage direct-field amplifier with the main field winding adjusted to a supercritical value, may then be of the order 10^4.

A simplified grapho-analytical method for the calculation of the transient processes is presented which makes it possible to consider the saturation of the magnetic circuit. An operator equation is derived, which is particularly appropriate for stability investigations and the calculation of the stabilising element of automatic control systems using a three-stage amplifier. The use of a laminated frame improves the high-speed action of the amplifier. — " Transient Processes in a Three-Stage Direct-Field Rotary Amplifier," P. V. Kuropatkin, *Elektrichestvo*, No. 10, pp. 38-42, 1959, in Russian.

A.E.I. REORGANISATION

DETAILS of the changes in the organisation of Associated Electrical Industries, Ltd., which became effective on 1st January, were given in our issue of 27th November. The diagram below will help readers to understand the present three-tier structure of the company and the grouping of the product divisions. At the centre is what Lord Chandos has referred to as the " focus of direction "—the A.E.I. board and a number of service departments, to which report directly the overseas and export companies, the home district offices and A.E.I.-Hotpoint, Ltd. In Rugby, Manchester and Woolwich are the three companies which, under their new titles, will continue to manage the product divisions.

Other companies which ceased to trade from 1st January and whose activities are being reorganised into the various product divisions are Sunvic Controls, Ltd., W. T. Henley's Telegraph Works Co., Ltd., and the Liverpool Electric Cable Co., Ltd. The business formerly handled by Sunvic Controls will be merged into the Instrumentation Division; that of the Liverpool Electric Cable Co. into the Cable Division; and that of Henley's into the Cable Division and Construction (Cables & Lines) Division. The other divisions were formed on 1st July, 1959, when the business of Ferguson Pailin, Ltd., was absorbed in the Switchgear Division.


Associated Electrical Industries, Ltd.
Associated Electrical Industries (Manchester), Ltd. (Formerly Metropolitan Vickers Electrical Company, Ltd.)
A.E.I. Turbine-Generator Division
A.E.I. Switchgear Division
A.E.I. Transformer Division
A.E.I. Traction Division
A.E.I. Instrumentation Division
Associated Electrical Industries (Rugby), Ltd. (Formerly the British Thomson-Houston Company, Ltd.)
A.E.I. Heavy Plant Division
A.E.I. Motor and Control Gear Division
A.E.I. Electronic Apparatus Division
A.E.I.-Birlec, Ltd.
A.E.I. Lamp & Lighting Company, Ltd.
Associated Electrical Industries (Woolwich), Ltd. (Formerly Siemens Edison Swan, Ltd.)
A.E.I. Cable Division
A.E.I. Construction (Cables & Lines) Division
A.E.I. Telecommunications Division
A.E.I. Radio and Electronic Components Division
A.E.I.-Hotpoint, Ltd.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review.*

Second Hunter Memorial Lecture

PROTECTION OF A.C. SYSTEMS

The first lecture in this series dealt with the life and work of P. V. Hunter. Subsequent lectures will deal with the present state and probable developments in some specialist field of electrical engineering. This article, by H. G. Bell, M.Sc.Tech., M.I.E.E., summarises the second lecture, which he gave yesterday (Thursday) at the I.E.E. in London

SIXTY years ago h.v. feeders and generators had no other protection than fuses of various designs and efficiencies and operators were provided with wooden tongs to " clutch " fuses from a safe distance. Engineers detected faults by the change in the note of the machinery. From these crude beginnings the science of protection has developed to give steadily improved performance under conditions becoming progressively more onerous.

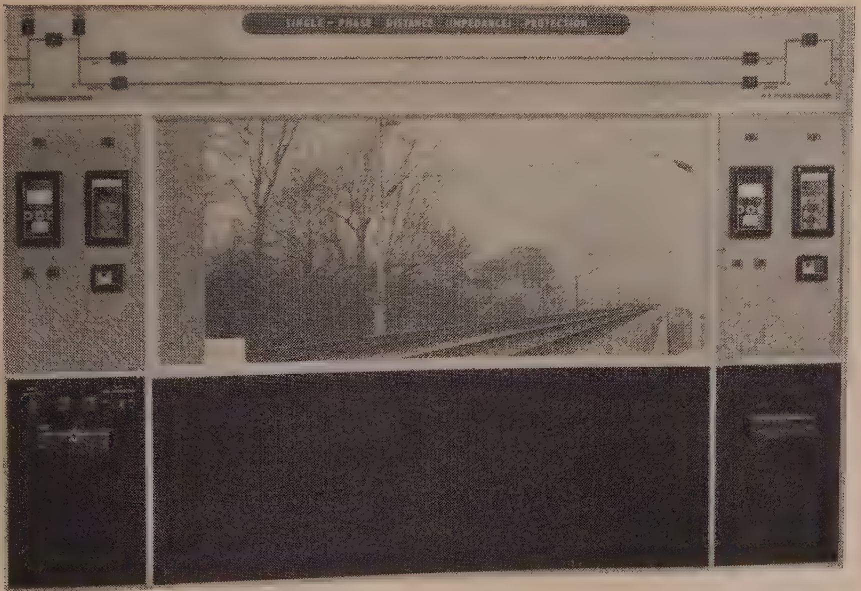
Early experience with h.v. systems indicated not only that adequate protection is essential to ensure continuity of supply, but that considerable economies are possible in the design of networks if efficient protection can be relied upon to minimise outage of feeders and other equipment. The main requirements for protective gear are speed and discrimination. High speed of operation ensures short duration of faults to limit shock to the system and damage at the point of failure. Discrimination includes the twin requirements of stability at all times of faults on other sections of the network, and the ability to recognise and operate correctly when fault conditions arise on the particular section concerned.

The various methods of discrimination may be placed in four groups. The first and simplest includes all time graded overcurrent relays, usually with an inverse current time characteristic, and associated when necessary with directional relays. The second, based on the original Merz Price principle of a comparison of the currents entering and leaving a particular section of the system, includes all unit types of protection. Such systems are designed to give rapid clearance under all conditions of unbalance, but to remain stable for all other faults on the system. A third group known generally as distance relays measure the voltage and current at the point of relaying and deduce the distance of the faults from the apparent impedance, reactance or admittance of the fault path. A fourth group accommodates all the miscellaneous types of protection such as negative phase sequence, thermal and neutral displacement relays. Special mention may be made of the gas and surge operated Buchholz relay used to protect transformers from internal faults of all kinds and low oil level.

Many occasions arise when it is necessary to operate distant breakers to ensure complete clearance of a fault. This is done by various types of intertripping schemes which may operate over pilot cables laid for the purpose, by d.c. or audio impulses sent over channels rented from the G.P.O., by h.f. carrier signals sent over the h.v. lines themselves, or in some cases by applying an artificial fault to the feeder concerned.

Fuses are still used extensively, but mostly on medium-voltage circuits. The modern h.r.c. fuse is accurate and can give reliable discrimination in suitable circumstances. A great advantage of the fuse is its property, due to its high speed of operation, of limiting the fault energy in a circuit and in consequence the amount of damage.

Modern protective gear comprises not only the protective relays, with their auxiliary relays, but also current and voltage transformers, line traps, marshalling kiosks, tripping batteries, operation indicators and extensive networks of secondary wiring and multi-core cables. The installation, testing and maintenance of the whole of this system must be of a high order if satisfactory results are to be obtained. Many system faults are complex, and it is usual today to install recording apparatus with a memory feature to record system conditions before and during a fault, and the consequent relay and switch operations.



A panel used during the lecture for demonstration of impedance protection equipment for British Railways (by courtesy of A.E.I., Ltd.)

In addition to the mechanical and electrical improvements in relays and other items of equipment during the last half-century, the science of protection has largely passed from the rule of thumb stage. Today large systems can be set up on calculators to review fault conditions and current distribution and for stability studies, whilst many of the phenomena arising during system transients have been reduced to mathematical treatment. In parallel with this, much of the protective gear in use today has been proved on heavy current testing equipment in the laboratories, with the result that a very high performance figure has been obtained in service.

INDUSTRIAL NEWS

Electrical Engineers' Exhibition

The ninth National Electrical Engineers Exhibition (Earls Court, 5th-9th April) will be opened by the President of the Board of Trade, Mr. Reginald Maudling. Part of the "Marine Electrics" display will be devoted to electrical and electronic equipment from the aircraft carriers H.M.S. *Victorious* and H.M.S. *Hermes*. Also shown will be equipment as used in the s.s. *Canberra*. Exhibits will include the latest navigational aids and radar, and radio communications equipment. An electrolier will be suspended from the roof of the Exhibition Hall. Measuring 75ft in circumference and built by William McGeoch & Co., Ltd., it will utilise a completely new design based on molecular models and incorporate many specially designed lighting accessories. Its total loading will be around 18·5 kW.

To demonstrate the growing importance of floor-type heating, visitors will walk on the world's largest electrically heated carpet, made by Thermalay, Ltd. Covering over 1,000 sq ft it will have a loading of more than 11,000 W. For the first time there will be a special display of outdoor electrical equipment. An area of over 5,000 sq ft will be devoted to large transformers built by the English Electric Co., Ltd., and other leading manufacturers. One of Britain's latest 85-ton electric locomotives, built by the Metropolitan-Vickers Electrical Co., Ltd., for shipment to South Africa, will also be on show.

Inquiry into Shell Site Dispute

The Minister of Labour has appointed Mr. Roy M. Wilson, Q.C., to be chairman, and Mr. D. K. Rollit, O.B.E. and Mr. W. D. Goss, O.B.E., to be members of a Committee of Investigation which is to inquire into the causes and circumstances of the dispute concerning the terms and conditions of employment of members of the Electrical Trades Union employed by F. H. Wheeler & Co., Ltd., at the Shell Centre Site, South Bank, London, S.E.1. It is hoped that the Committee will begin its work on 11th January.

Admiralty Departmental Change

As forecast in the 1959-1960 Navy Estimates speech, a new department of the Admiralty—the Navy Works Department—came into being on 1st January. This department takes over the duties and responsibilities previously exercised by the Civil Engineer-in-Chief and also, in Admiralty Shore Establishments outside the Royal Dockyards, the electrical and mechanical engineering work hitherto the responsibility of the Director General of Dockyards and Maintenance. The new organisation, by bringing civil, electrical and mechanical engineering work in the shore establishments within a single department, will ensure simpler working and make co-ordinated programming easier.

The first Director General of Navy Works is Mr. W. G. Harris, M.A., M.I.C.E., the former Civil Engineer-in-Chief, who will be assisted by three Directors of Navy Works, Mr. C. F. Marshall, B.Sc., M.I.C.E., Mr. J. W. Hunter, B.Sc., M.I.C.E., and Mr. F. B. Allcock, B.Sc., M.I.E.E., the last being responsible for the electrical and mechanical engineering work in the new department. Mr. T. Rishworth, F.R.I.C.S., is the chief quantity surveyor and Mr. E. H. Palmer, F.R.I.C.S., the chief surveyor of lands.

Westool Enter Domestic Market

Westool, Ltd., manufacturers of electrical control equipment, have entered the domestic electrical equipment market for the first time. They are now producing the "Cotswold" fan heater at their Durham factory, having acquired the manufacturing rights from New Day Electric, Ltd. (now in voluntary liquidation). The standard 2 kW model, finished in maroon and grey, retails at £7 7s 4d, including purchase tax, and is obtainable either direct from the manufacturers or through wholesalers.

Heating Mantle

A large heating mantle made by Isopad, Ltd., Boreham Wood, Herts., has been used for the testing of 60in bore valves at the works of Glenfield & Kennedy, Ltd., Kilmarnock. Thirty-two of these valves are being installed at the Hunterston nuclear power station. They are tested at full design pressure whilst the "Isomantle" heats them to 800°F. This is the operating temperature for the outlet valves, while the inlet valves operate at 450°F. The control panel seen in the background of the illustration provides coarse control for each section of the heating mantle and the required high accuracy is automatically achieved by additional transistorised controls.

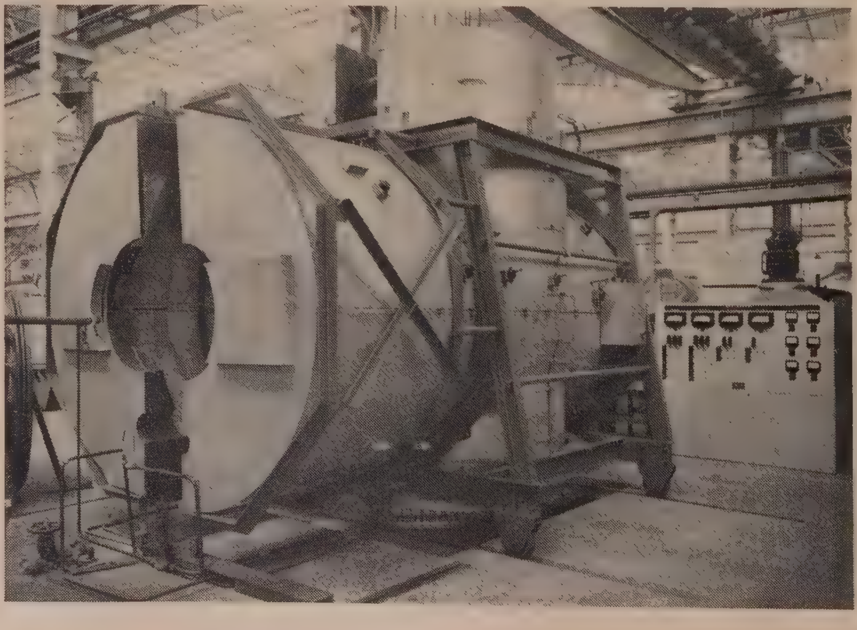
Early Re-start at Hunterston?

It is hoped that work at the Hunterston nuclear power station will be re-started on Monday next by the Motherwell Bridge & Engineering Co., fifteen weeks after the company suspended operations because of continued strikes. This hope was expressed last week by Mr. G. D. T. Wilson, industrial commissioner for Scotland of the Ministry of Labour, after a conference with representatives of the company, the General Electric Co., Ltd., and the trade unions concerned. As a result of these disputes the work is about fifteen months behind programme.

Heated Bridge Surface

A bridge being erected in Basildon New Town, Essex, to carry one of the new main roads over the London-Southend railway line will have an electrically warmed road surface. The bridge will consist of three separate spans and have a total length of 104ft, a single carriageway 24ft wide and two 9ft wide footways. There is a gradient on the approach road to the bridge and on the bridge itself. As the rail-

Isopad heating mantle for valve testing



way line is being electrified, solid parapet walls 6ft high are required. Electric warming cables of high resistance copper-based alloy which have been designed to resist moisture, heat and the effects of oils, sulphates and chemicals will be installed by the Eastern Electricity Board.

B.E.A.M.A. Export Sales Conference

Further details have been announced of the one-day Export Sales Conference which (as reported in our issue of 18th December) the B.E.A.M.A. Domestic Appliance Division are holding on Wednesday, 10th February, at the Connaught Rooms, London, W.C.2. Though primarily intended for member firms, it has been decided to invite all manufacturers of domestic electrical appliances and equipment to attend. The speakers will include Mr. Reginald Maudling, President of the Board of Trade, Lord Chandos and Sir Leslie Gamage.

The conference is designed to appeal to managing directors, export managers and executives, as well as to others not so directly involved in export work, such as design engineers and technical personnel. Subjects for discussion will avoid anything which could be described as having a textbook flavour and the speakers will apply themselves to the practical problems involved in seeking to increase exports.

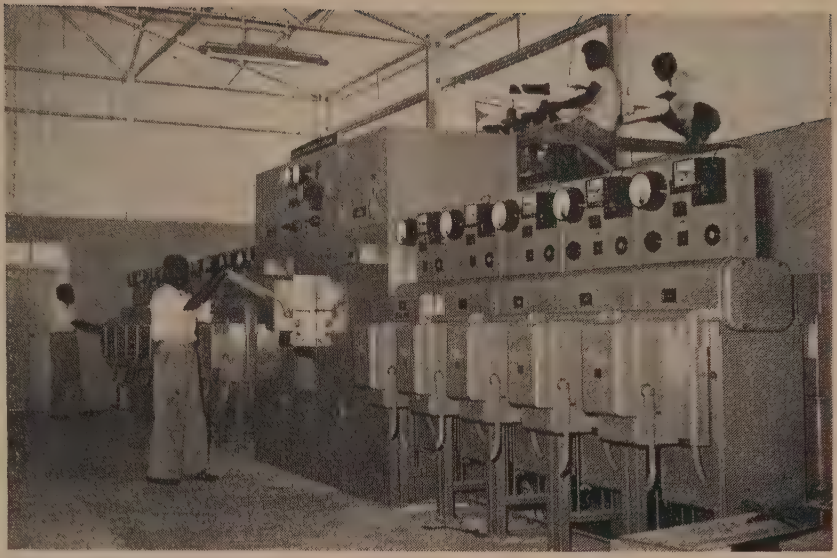
The registration fee is three guineas per person; this will include an informal luncheon and refreshments; a printed programme and a full report of the conference proceedings. Application should be made to the B.E.A.M.A., 36, Kingsway, London, W.C.2, not later than Saturday, 16th January.

Power Farming Conference

Over 1,000 farmers and agriculturists, including overseas delegates, are to take part in the Ninth National Power Farming Conference which is being held at Cheltenham from 9th to 11th February. The theme of the conference—organised by *Practical Power Farming* and *Farmer and Stock-Breeder*—will be "Methods and Machines for Arable and Livestock Farming." Full details can be obtained from the Organiser, National Power Farming Conference, Dorset House, Stamford Street, London, S.E.1.

Aircraft Maintenance Fire Precautions

Recommendations for the reduction of fire risk in aircraft maintenance work are contained in a booklet published by the Fire Protection Association, 31-45, Gresham Street, London, E.C.2, under the title "Fire Protection and the Maintenance of Aircraft" (price to non-members 2s). The first section, dealing with the construction and equipment of hangars, gives advice on electrical installations. It is stated that these should conform to the I.E.E. Regulations; that main distribution and associated metering parts should be in separate rooms of fire-resisting construction; and that it is advisable to provide main cut-off switches outside the hangar. For electric space heating flameproof systems are recommended and it is stipulated that for lighting only electricity should be employed. Power installations within hangars should be designed to minimise the necessity for flexible leads.



The main 19-panel, 400 V, Crompton Parkinson switchboard in the indoor substation of the Dunlop Rubber Co. (India), Ltd., factory at Ambattur, Madras

Precautions during maintenance work are dealt with in the next section. The desirability of energising only those circuits which are essential at any one time is stressed and precautions to be taken when batteries are being fitted or moved are briefly mentioned.

In the third section, "Fuelling of Aircraft," it is recommended that electrical equipment in the fuelling zone should be flameproof and that only essential equipment should be used during fuelling.

B.R.A. Luncheon

The British Refrigeration Association announces that its annual luncheon will take place on 25th March at the Connaught Rooms, London, W.C.2. Mr. Reginald Maudling, M.P., President of the Board of Trade, has accepted an invitation to attend. It is anticipated that the chairman of the Association, Mr. John A. Howie (managing director, Lightfoot Refrigeration Co., Ltd.) will preside.

E.D.A. at the Schoolboys' Exhibition

One of the most popular stands at the Schoolboys' Own Exhibition now being held at Olympia, London, is that of the British Electrical Development Association. Boys are invited to make a journey through the Halls of Today, Tomorrow and Beyond, in each of which there is a series of tableaux and work stations where they are able to operate various appliances. Exhibits include such items as an electronic smoke controller, infra-red heat detector, a model of Calder Hall and light machines for obtaining energy from the sun, as well as a "death-ray machine" for use in outer space only. During the course of their tour the boys are accompanied by a guide who either demonstrates or explains the working processes.

Finally, the boys are able to make a "Trip to the Moon" in a giant rocket which dominates the front of the stand. Careers and educational literature is available for distribution to interested inquirers and representatives of Area Electricity Boards and the C.E.G.B. are in attendance to advise on future careers in the electrical industry.

Goblin (B.V.C.), Ltd.

As we have already reported, the British Vacuum Cleaner & Engineering Co., Ltd., has changed its name to Goblin (B.V.C.), Ltd. The name of the British Vacuum Cleaner & Engineering Co., Ltd., is being retained for a subsidiary which will market all industrial vacuum cleaners.

Intrinsic Safety Certificate

The transistorised capacitance operated level control equipment manufactured by Lancashire Dynamo Electronic Products, Ltd., Rugeley, Staffs., has been approved by the Factory Inspectorate as being intrinsically safe as defined in British Standard 1259 of 1958. Certificate Number IS.3086 has been granted for the hydrogen/ethylene/pentane class, which includes many gases encountered in industrial processes, of which one of the most important is the petroleum group. The units, which utilise standard fittings for probes and other accessories, are now in production and the manufacturers will provide further information in respect of any specific application problem.

Industrial Lighting Conference

The British Lighting Council is holding a conference on industrial lighting on 20th January at Brettenham House, 16-18, Lancaster Place, London, W.C.2. The fee for the conference is 10s 6d and registration forms should be completed and returned to Mr. G. B. Durham, London regional engineer, B.L.C., at the above address, by 12th January.

Electrical Appliance Newcomers

The *Albion Works Bulletin* of John Harper & Co., Ltd., states that the company has made a contract with a Swiss firm of refrigerator manufacturers to import a small domestic refrigerator which will be sold under the company's own name throughout the United Kingdom. This is the company's first marketing of an electrical appliance; it is its intention to manufacture and market other electrical appliances in due course.

Continental 50 c/s Locomotives for India

The first of 100 ignitron locomotives ordered by the Indian Government for use on the lines around Calcutta, which are electrified at 25 kV, 50 c/s, has recently been shipped from Belgium. The order was placed with a consortium of Continental firms formed for the purpose of designing and constructing 50 c/s railway electrification schemes. Electrical equipment for the locomotives is being supplied by A.C.E.C. (Belgium), Alsthom and M.T.E. (France), Brown Boveri and Oerlikon (Switzerland), and A.E.G. and Siemens (Germany). Mechanical parts are being made by Belgian, French and German companies and, to meet the delivery schedule of 15 locomotives a month, final assembly is being shared between these three countries.

Sheffield University Library Lighting

Specially designed raising and lowering gear has been used with the modular lighting fittings in the new library at Sheffield University to overcome a complex problem of maintenance. The lights are fitted into the ceiling of the library which is 17ft above floor level. The use of ladders to obtain access would have been impossible and raising and lowering gear was the only means of overcoming the problem, but because the fittings had to return to their places in the ceiling with only $\frac{1}{8}$in clearance all round special gear was designed and made by the London Electric Firm, Ltd., Croydon, to achieve the necessary accuracy. During the design stage a sample lighting fitting was obtained from the makers, a section of ceiling borrowed from the ceiling manufacturers and a "mock up" of an installation built in the factory. A complete trial set of equipment was built and sent to Sheffield for installation. After minor modifications the complete order for forty-six sets of gear was put in hand.

The installation is designed so that the raising and lowering gear is invisible and operation is by means of a winch handle situated above the firebreak slab. When a fitting is wound up to its normal position electrical contact is automatically re-made and the fitting is "locked in" to its housing so that the weight is taken off the winch rope. The lighting fittings were supplied by the A.E.I. Lamp & Lighting Co., Ltd., and the ceiling sections by Frenger Ceilings, Ltd. The electrical consultant for the work was Mr. H. B. Leighton, M.A., F.R.I.B.A.

The new library at Sheffield University showing the modular lighting fittings equipped with specially designed raising and lowering gear to provide facilities for cleaning and servicing

Further Hoover Developments in Wales

Hoover, Ltd., has acquired the lease from Wales & Monmouthshire Industrial Estates (acting for the Board of Trade) of a 68,000 sq ft factory at Merthyr Tydfil on the opposite side of the road from the main factory building of Hoover (Washing Machines), Ltd. The factory will be used for washing machine production and with the existing five Hoover factories in the Merthyr Tydfil area, and an extension at present being built, will bring the total area occupied in South Wales by the Hoover Washing Machine enterprises up to some 800,000 sq ft.

Electronic Components Exhibition

Exhibitors from 15 different countries will be showing components and complete electronic equipment at the third International Exhibition of Electronic Components which will take place from 19th to 23rd February in the Parc des Expositions at the Porte de Versailles in Paris. Exhibits to be seen on the 400 stands will include electronic tubes and transistors, measuring instruments, power supply units and other electronic components. The exhibition is organised under the patronage of the National Federation of Electronic Industries by the Industries Association for Radio, Electric and Electronic Components and Accessories. Further details can be obtained from the Federation, 23, Rue de Lubeck, Paris XVIe.

Refrigeration Engineers' Development

Gardiner, Sons & Co., Ltd., announce the formation of the following new subsidiary companies:—Gardiner Refrigeration Holdings (Western), Ltd., to co-ordinate and control the activities of all the group's refrigeration subsidiary companies, including Gardiner Refrigeration (Bristol), Ltd., a new company formed to take over the activities of the parent company's Refrigeration Departments at Bristol and Cheltenham; the Somerset Refrigeration Co., Ltd., acquired by Gardiner, Sons & Co., Ltd., in 1956; and Arthur Brand Refrigeration, Ltd., Plymouth, acquired by Gardiner, Sons & Co., Ltd., on 1st October last.

Industrial Heating Course

Pye, Ltd. (Process Heating Division), is holding a second induction heating course on 1st and 2nd March. It will cover the same subjects as the first course—theory of induction heating, how the generator works, and the design of the coils for hardening, annealing, tempering, brazing and soft soldering. Further details can be obtained from Mrs. E. Raeburn, Pye Process Heating, 28, James Street, Cambridge.

Canadian Microwave Radio Communication Link

A new microwave link between Moncton and St. John in New Brunswick, Canada, and operating in the 2,000 Mc/s frequency band, was commissioned on 12th December. This link is being primarily used for telephony transmissions, but can be switched over to transmit television signals when required. The latest type of G.E.C. transmission equipment is employed, in which built-in metering facilities and plug-in panels are used to speed installation and minimise maintenance. Work is already in progress to extend the link from Moncton to Campbellton and from St. John to Halifax and Sydney. The equipment is manufactured by the General Electric Co., Ltd., England, and installed by the Canadian General Electric Co.

A.E.I.-Hotpoint Price Reduction

A.E.I.-Hotpoint, Ltd., has announced to Electricity Boards new terms for its radiant rings, effective from 1st January. Net prices to Boards are reduced by approximately 8½ per cent and the guarantee has been increased to two years from date of installation.

Calendars and Diaries

The London Electricity Board has sent us a pocket diary bound in maroon leatherette in which the constitution and other information is given regarding the Board, adjoining Area Boards, the C.E.G.B. and other organisations.

Nalder Bros. & Thompson, Ltd., have sent us a desk calendar with monthly cards.

The calendar received from A. A. Jones & Shipman, Ltd., has large monthly sheets, each of which has a reproduction from a water-colour of a rural scene.

Studies of children adorn the monthly sheets of a calendar received from Chloride Batteries, Ltd., who have also sent us a neat diary.

The Henry VIII Gateway, Windsor Castle, makes an attractive picture for the calendar received from the Lindley Thompson Transformer & Service Co., Ltd.

A nineteenth century scene of an angler displaying his catch makes a colourful picture for the calendar received from Fitter & Poulton, Ltd.

Scottish Instrument Company

A new company, Willis Instruments, Ltd., has been formed in the West of Scotland to manufacture gas detecting instruments and alarms to certified and approved designs. It will also provide 24-hour servicing and maintenance facilities for all types of electrical and electronic scientific instruments. Mr. Alex. N. Willis, the managing director of the new company, was until recently chief development engineer (instruments) with the Mine Safety Appliances Co., Ltd., Glasgow.

Trade Announcements

The **Wandsworth Electrical Manufacturing Co., Ltd.,** announces that from 11th January its London office will be at Portman Chambers, 7-9, Baker Street, W.1 (telephone: Hunter 3201).

Aerialite, Ltd., has built a new branch in London at 11-12, Paddington Green, London, W.2 (telephone: Ambassador 3231). The branch includes new showrooms, a trade counter and stores. Part of the offices are heated with the Aerialite under-floor system to enable customers to judge the efficiency of this type of heating.

Nife Batteries, of Redditch, are setting up an additional sales engineering area. This will be known as the North Midlands area and will include Sheffield, Barnsley, Doncaster, Scunthorpe, Derby, Nottingham and Lincoln and the surrounding districts. The engineer in charge of this new area will be Mr. P. Sandels, formerly of the Manchester area, and he will be at 4, Ordsall Park Road, Retford, Notts. (telephone: Retford 2330).

The **Birmingham Tool & Gauge Co., Ltd.,** of Soho Hill, Birmingham, 19, has secured the sole distribution rights for the electromagnetic bench production tools manufactured by Black & Webster, Ltd., of Massachusetts, U.S.A.

The works of **Birmingham Power Transmissions, Ltd.,** have been transferred to 141-147, Lionel Street, Birmingham, 3 (telephone: Central 6581/2/3). The offices and showrooms will remain at 117-118, Snow Hill, Birmingham, 4 (telephone: Central 5364).

Richard Thomas & Baldwins, Ltd., announce that all sales of electrical sheet and strip manufactured at the Midland Section are now handled by Richard Thomas & Baldwins (Sales), Ltd. The Midland Section Sales Department for electrical sheet and strip has been transferred to Richard Thomas & Baldwins (Sales), Ltd., but will continue to operate from Wilden, Stourport-on-Severn. Mr. P. M. J. Boulasse has been appointed manager of the department and will be at the head office of Richard Thomas & Baldwins (Sales), Ltd., 47, Park Street, London, W.1. Mr. G. F. Astle and Mr. R. G. Martindale, M.Sc., M.I.E.E., have been appointed joint sales managers of the department and both will be at Wilden.

A reorganisation of the Motors Division of **Westool, Ltd.,** St. Helen's Auckland, Co. Durham, has just been completed and the design section has been considerably enlarged.

High Duty Alloys, Ltd., has closed its Hillington, Glasgow, office and opened a new one at De Quincey House, 48, West Regent Street, Glasgow, C.2 (telephone: Douglas 1500).

The London office of **Craven Brothers (Manchester), Ltd.,** is now at 139, Park Lane, W.1 (telephone: Mayfair 6783).

The telephone number of **Electropol Processing, Ltd.,** Trading Estate, Farnham, Surrey, has been changed to Farnham 3355.

Change of Name

The name of Claude-General Neon Lights, Ltd., has been changed to Claudgen, Ltd.

Nuclear Power Group

IN August last it was announced that negotiations were in progress between the Nuclear Power Plant Co., Ltd., and the A.E.I.-John Thompson Nuclear Energy Co., Ltd., with a view to arranging collaboration between the two companies on nuclear matters. Since then it has been agreed that the two companies become partners on an equal basis in all respects as from 1st January, under the name of the Nuclear Power Group. The head office of the group will be at Radbroke Hall, Knutsford, Cheshire. The constituent members of the N.P.G. are:—Associated Electrical Industries, Ltd.; Clarke, Chapman & Co., Ltd.; Alex. Findlay & Co., Ltd.; Head, Wrightson & Co., Ltd.; Sir Robert McAlpine & Sons, Ltd.; C. A. Parsons & Co., Ltd.; A. Reyrolle & Co., Ltd.; Strachan & Henshaw, Ltd.; John Thompson, Ltd.; and Whessoe, Ltd.

Each partner will have three representatives on the board, the first board consisting of the following members:—Viscount Chandos (chairman), Sir Edward Thompson and Mr. H. West (representing A.E.I.-J.T.); Mr. R. Edwin McAlpine (vice-chairman), Mr. H. H. Mullens and Sir John G. Wrightson, Bt. (representing the N.P.P.C.), together with Mr. A. J. Sayers (general manager). The senior executives of the N.P.G. will be:—Mr. S. A. Ghalib (deputy general manager), Mr. W. A. K. Wicks (secretary), Mr. R. D. Vaughan (chief engineer) and Mr. J. R. M. Southwood (deputy chief engineer).

The primary objects of the N.P.G. are to assist the partner companies to complete Berkeley, Bradwell and Latina (Italy) nuclear power stations; the design, development and sale of nuclear reactors of all kinds; the construction of complete nuclear power stations at home and abroad; the construction of nuclear units for ship propulsion; the supply of components and materials peculiar thereto; and research and development in matters concerning nuclear energy.

The N.P.P.C. have running contracts for the design and construction of nuclear power stations at Bradwell, Essex (300 MW), and Latina, Italy (200 MW); similarly, A.E.I.-J.T. are engaged on the nuclear power station at Berkeley, Glos. (275 MW). These contracts will be continued to completion by the two companies. The staffs of the N.P.P.C. and A.E.I.-J.T. will belong to the Nuclear Power Group. To fulfil existing contractual obligations, however, staffs familiar with these projects will continue to be employed on them for the N.P.P.C. and A.E.I.-J.T.

GENERATION and DEVELOPMENT

Cheaper Electricity in Ulster

The Electricity Board for Northern Ireland has announced a reduction of about 4 per cent in electricity charges and lower guarantees for rural extensions. These concessions are estimated to benefit consumers by some £200,000 in the first full year. The 4 per cent reduction arises from changes in the fuel price clause, the new basic figure for which is 70s a ton (against 65s), and the "unit" adjustment 0·009d (previously 0·01d) for each shilling variation in the fuel price.

Mr. James Walker, chairman of the Board, explained that the lowering of charges had been achieved by overall improvements in generating costs and a satisfactory increase in sales of electricity and appliances. A higher proportion of the total power was now being generated by larger and more efficient plant. Sales of electricity in the past year had increased by more than 8 per cent.

Corporation Electrical Work in Liverpool

Liverpool City Lighting Committee is continuing to press for all electrical installation and maintenance work, now carried out by no fewer than eight independent departments, to be centralised in the City Lighting Department. At the December meeting of the Council it was agreed that as from next April all electrical work to Education Committee premises should be done by the Lighting Department.

At a meeting of the Lighting Committee on 14th December consideration was given to a report from the town clerk and the city treasurer stating that the electrical work done by the Baths and Washhouses, Public Health, Architectural and Housing, Markets, Passenger Transport and Water Departments was specialised and better left to those departments. The electrical work done by the City Engineer and Surveyor's Department included specialised work to meet the needs of that department. Much of the city engineer's electrical work was carried out by private contractors on a competitive basis, and as grants were now available for much of this work, there could be difficulty if the competition factor were ruled out by centralisation.

River Crossing

The River Wear Commissioners have approved an application by the Central Electricity Generating Board to construct a 275 kV line across the river in the vicinity of Offerton Haugh. The minimum height will be 63ft 8in above high water mark, and it is stipulated that if at any time it is necessary to raise the height of the cable because of traffic on the river, the Generating Board will do so upon receiving notice from the Commissioners.

Scottish System Reinforcements

A major scheme for the reinforcement of the supply to Paisley has been approved by the South of Scotland Electricity Board. At present the town is supplied at 6·6 kV from Blackhall Street grid substation to which are connected two circuits, one from Braehead generating station and the other from the recently constructed 132 kV switching station at Neilston. The distribution voltage is being raised to 11 kV and for that purpose two 60 MVA 132/33 kV transformers and a nine-panel 750 MVA 33 kV switchboard will be installed at Blackhall Street. Two new 33/11 kV substations to be fed from Blackhall Street will be constructed at Sherwood and Barterholm, and larger transformers and switchgear will be installed at the Ferguslie Mills substation. The total cost will be of the order of £750,000.

To meet the increasing electricity load in Fife, the Board proposes to reinforce the high voltage transmission system. For this purpose a new 132 kV substation will be established at Westfield, near Ballingry, equipped with two 60 MVA 132/33 kV transformers and two 132 kV circuit-breakers. In addition to general requirements, the new substation will supply the Scottish Gas Board's Lurgi plant at Westfield and the adjacent open-cast coal site of the National Coal Board. The work, which includes extensions and modifications to the 33 kV distribution network, will cost approximately £400,000.

Clatworthy Dam, Somerset, constructed by Holland & Hannen and Cubitts, Ltd., has been partly designed to provide Hinkley Point nuclear power station with one million gallons of water per day

Progress at Blyth

The third of the four 120 MW generators at the new Blyth "A" power station has now been brought into operation, and the fourth will be commissioned in March. Work on the new Blyth "B" station is in hand and the first of its two 275 MW generators will be completed in 1962.

Estate Supply Terms

Local authorities in County Durham are being advised by the town clerk of Sunderland, acting on behalf of local Councils generally, not to depart from the terms arranged some years ago with the North Eastern Electricity Board for supplying electricity to new housing estates. The town clerk stated that any variations of the terms should be negotiated either regionally or nationally.

Electrical Services in Flats

In connection with improvements at the Southwold Road flats, Hackney Housing and Town Planning Committee has approved a proposal to install electric water heaters, supplying hot water to the sink as well as the bath. The estimated cost is £7,000. The installations are to be completely rewired at a cost of £4,250, new cooker circuits being provided.

All-Electric Houses

Motherwell and Wishaw Town Council has accepted a recommendation by its Housing Committee that 100 houses to be built at Coltness (East Side) housing scheme shall be equipped with electrical apparatus for heating, lighting and cooking. Work on the houses will start in the spring.

G.E.C. General Products Group

The General Electric Co., Ltd., has reorganised its General Products Group. Five new groups have been formed and each will be under the control of a group managing director, who will be responsible for the overall planning, direction and control of the activities of each group, including design, development, production, sales and distribution.

The groups and their managing directors are as follows:—

Domestic Equipment Group, incorporating the present Domestic Equipment Division: Mr. E. A. Fowler, M.I.E.E., F.I.E.S.

Installation Equipment Group, incorporating the present Installation Equipment Division and Pirelli-General Cable Division: Mr. R. H. Phillips, T.D., Associate I.E.E.

Lighting and Heating Group, incorporating the present Lighting Division and Industrial Heating Department: Mr. D. L. Tabraham, M.A.(Cantab.), F.I.E.S.

Osram Group, incorporating the present Osram Lamp Division and all glass and lamp component units: Mr. A. E. Page.

Radio Group, incorporating the present Radio Division: Mr. M. M. Macqueen.

Mr. Fowler, who joined the G.E.C. in 1955, became general manager, Northern England, in November, 1958. He has been closely associated with reorganisation work and commercial administration at head office. Before joining the company he was chief commercial officer of the Eastern Electricity Board from 1949, having previously served as a member of the managerial executive of the Yorkshire Electric Power Co. Group from 1938. While with the Eastern Electricity Board, Mr. Fowler served for several years on the Union Internationale des Producteurs et Distributeurs d'Energie Electrique Utilisation Committee as a representative delegate for the British Electricity Authority. He has served for many years on committees of the E.D.A., and was vice-chairman of the North Midland Centre of the Institution of Electrical Engineers in 1947-48, having previously served as chairman of the Utilisation Section of the Centre in 1947. He is also vice-chairman of the East Anglian Sub-Centre Committee.

Mr. Phillips joined the G.E.C. in 1926 at Witton and transferred to the sales side of the company in 1928. In 1939 he became manager of the Installations Materials Department at Birmingham. Commissioned in the Royal Engineers (T.A.) in 1939, he transferred to the Royal Artillery and attained the rank of major. In 1945 he was awarded the Territorial Decoration. After the war, in 1946, he was appointed manager of the Leicester branch and in 1949 became assistant manager of the Midlands area. Mr. Phillips was appointed area manager—his present position—in 1957. Mr. Phillips is an ordinary member of the Council of the Institution of Electrical Engineers and was hon. secretary of the South Midland Centre from 1949 to 1954.

Mr. Tabraham, after graduating at Cambridge, joined the G.E.C. Research Laboratories in 1937 as a trainee in the illuminating engineering section, after which he transferred to the Illuminating Engineering Department at the head office. At the end of 1940 he was appointed manager of the Lighting Department for the North-East area, based in Newcastle, but was later seconded to the Admiralty. He re-joined the G.E.C. in 1946 and held his former position until 1949 when he returned to head office in London, being appointed manager of the Lighting Fittings Department in 1951. Six years later he became manager of the newly formed Lighting Division which comprised the Lighting Fittings and Exterior Lighting Departments.

Mr. Tabraham is president of the Electric Light Fittings Association (E.L.F.A.) and a vice-president of the Illuminating Engineering Society. He is also a member of the Electrical Fair Trading Council.

Mr. Page joined the G.E.C. in 1915. He was appointed assistant manager of the Osram Lamp Department in 1930, sales manager in 1946 and took over full management of the department in 1954 on the retirement of the late Mr. W. H. Williams. For many years he was associated closely with the work of the E.L.M.A. and was chairman of the Council in 1955. He is also the immediate past-chairman of the Electric Lamp Industry Council.

Mr. Page was closely concerned with the Lighting Service Bureau and played an active part in the formation of its successor, the British Lighting Council, of which he is the present chairman. When the Osram Lamp Division was formed in 1958, uniting the commercial and manufacturing responsibilities, Mr. Page became its first general manager. He is a director of a number of associated companies of the G.E.C., including Glass Bulbs, Ltd., Lamp Caps, Ltd., and British Sealed Beams, Ltd.

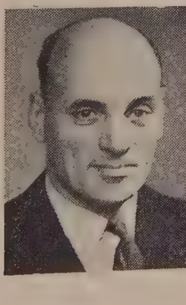
Mr. Macqueen became assistant to the manager of the newly-formed Radio Department of the G.E.C. in 1923, and was appointed manager in 1930. He has been widely connected with radio trade associations. He became chairman of the Radio Manufacturers' Association in 1937, and has held this office several times subsequently. A council member of B.R.E.M.A. since its inception, he was also an original member of the Radio Industry Council executive. During the last war Mr. Macqueen was on Advisory Committees to the Ministries of Aircraft Production and Supply. In 1946 he joined an industry delegation which went to India to advise the then Government on the development of its broadcasting system. He serves on a number of committees concerned with the broadcasting industry.

Epoxide Resin Applications

A booklet has recently been published outlining some of the uses of the range of epoxide resins marketed by Bakelite, Ltd. It is intended for use in conjunction with the advance information sheets and technical memoranda already issued on specific applications of the systems, and in this connection the chart entitled "Guide to Publications on Bakelite Epoxide Resins" which is enclosed will be useful for reference purposes. Copies of "Bakelite Epoxide Resins and their Applications" are available free of charge from the company at 12-18, Grosvenor Gardens, London, S.W.1.

Mr. E. A. Fowler

Mr. R. H. Phillips



Mr. D. L. Tabraham

Mr. A. E. Page

Mr. M. M. Macqueen

PERSONAL AND SOCIAL

News of Men and Women of the Industry

At a recent meeting of the British Electrical and Allied Manufacturers' Association Export Panel, **Mr. D. Maxwell Buist** retired from the chairmanship and **Mr. E. V. Small,** joint managing director of Associated Electrical Industries Export, Ltd., was elected to succeed him. **Mr. L. H. Short,** director of overseas operations, English Electric Co., Ltd., was elected vice-chairman. Mr. Small, on behalf of the Panel members, presented Mr. Buist with an inscribed silver cigar and cigarette box and paid tribute to him, not only as the founder and chairman of the Panel since 1948, but also for the way in which he had co-ordinated the export activities of B.E.A.M.A. members, with the result that the Panel was now recognised as one of the most important bodies within the B.E.A.M.A. organisation.

Mr. E. S. Little, Companion I.E.E., F.I.A.C., director of British Thomson-Houston, retired on 31st December after forty-eight years with the company. Mr. Little joined the B.T.H. Co. in 1912. After war service and a period as assistant to the comptroller, he was, in 1929, placed in charge of the General Accounting Department. He became comptroller in 1936 and retained that position when, in 1945, he also became secretary of the company. He was elected a director of B.T.H. in 1945 and resigned on appointment to the board of the A.E.I. Finance Co., Ltd., being re-appointed to the B.T.H. board as director of finance in 1957 on relinquishing the office of comptroller and secretary. He was also on the boards of various associated companies.

Mr. E. S. Little

Mr. E. B. M. Grubb, general sales manager of Davis & Timmins, Ltd., has been appointed a director of the company.

Mr. P. C. Raphael, director and general works manager of Hoover (Australia) Pty., Ltd., Sydney, has arrived in this country for a stay of nearly two months. With him are his wife and two sons.

Mr. J. B. Fair, A.M.I.E.E., has been appointed commercial officer of the Fife Area of the South of Scotland Electricity Board, in succession to **Mr. J. Burnett,** who is retiring. Mr. Fair is at present senior assistant sub-area commercial engineer of the Tyne Sub-Area of the North Eastern Electricity Board. Previously he held appointments with the South Western and Eastern Electricity Boards. He will take up his new appointment on 1st February.

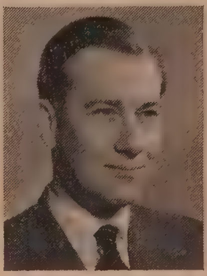
Mr. W. H. C. Pilling, B.A.(Hons.), M.I.E.E., has been appointed chief project engineer of the Northern Project Group of the Central Electricity Generating Board. In 1927, after taking a degree at Cambridge University and completing his apprenticeship, Mr. Pilling became assistant resident engineer with the Imperial Continental Gas Association at Droogenbosch generating station, Brussels. From 1928 to 1948 he was with the Yorkshire Electric Power Co., holding the positions of assistant engineer, and chief assistant to the construction engineer at the head office.

Mr. W. H. C. Pilling

On vesting day Mr. Pilling was appointed deputy generation engineer (construction), and in 1949 was promoted to generation engineer (construction), Yorkshire Division. From December, 1951, to April, 1954, he was with the Merseyside and North Wales Division, holding the post of chief generation engineer (construction). With the merger of that Division into the North West, Merseyside and North Wales Division he became deputy chief generation engineer (construction). In August, 1955, he transferred to headquarters as nuclear projects engineer, and held the position until March, 1958, when he was appointed assistant chief project engineer, Southern Project Group.

Three presentations were recently made to retiring members of the staff of the Eastern Electricity Board at Wherstead: **Mr. J. E. Blair,** chief accountant; **Mr. H. G. F. Gamble,** assistant chief commercial officer in charge of sales, service and contracting; and **Mr. T. Hardwick,** the caretaker. The presentations were made by the chairman of the Board, Mr. H. V. Pugh.

Mr. A. R. Pollard, A.M.I.E.E., assistant technical editor of the *Electrical Review,* has been appointed technical editor in succession to Mr. P. W. Tucker, whose retirement was recently announced. Mr. Pollard was born at Winchester in 1923 and was educated at University College, Southampton. After training with the Winchester Corporation Electricity Department he remained there until 1946. He then joined the Standard Telecommunication Laboratories, Ltd., as a research engineer, leaving in 1948 to become technical assistant on the editorial staff of the *Electrical Review.*



Mr. A. R. Pollard

Mr. B. P. Yates, F.C.I.S., secretary for many years to Low Moor Alloy Steelworks, Ltd., and its associated

[*Continued on page* 75

Electricity Supply Organisation

ON page 73 is a further revised version of our chart showing the structure of the electricity supply industry which first appeared in our issue of 14th March, 1958, and was last published on 23rd January last year. It shows the relationship of the Central Electricity Generating Board and the Area Boards to the Electricity Council, and the way in which the Boards are organised. The C.E.G.B. has ten Divisions grouped into five Regions. The Area Boards' systems consist of Sub-Areas composed of a varying number of Districts; the London and South Western Boards have departed from the general pattern by adopting a system wthout Sub-Areas but with larger Districts.

The chairmen of the Electricity Council and the C.E.G.B. each receive a salary of £10,000 a year and the deputy chairmen £7,500. Full-time members of these bodies are paid £7,000 and part-time members £1,000. The salary of an Area Board chairman is £6,500 and that of the deputy chairman £5,000, while part-time members receive £1,000 (except the chairman of the Area Consultative Council, an *ex officio* member, who is paid £1,500). The only full-time members of Area Boards (apart from the chairmen and deputy chairmen) hold executive appointments with their Boards and receive only the salaries attaching to their offices; there are about ten such members so far.

We are electrical, mechanical engineers, but anything complicated technically is beyond me. (I'm not an engineer, of course, just personal secretary to the Chairman who likes me to understand clearly what we do). It's quite simple. We put in lighting and power—in other words—we contract for complete industrial and commercial electrifications. We inspect, fix it, keep it running without a hitch—in other words—repairs, rewinds, inspection and maintenance.

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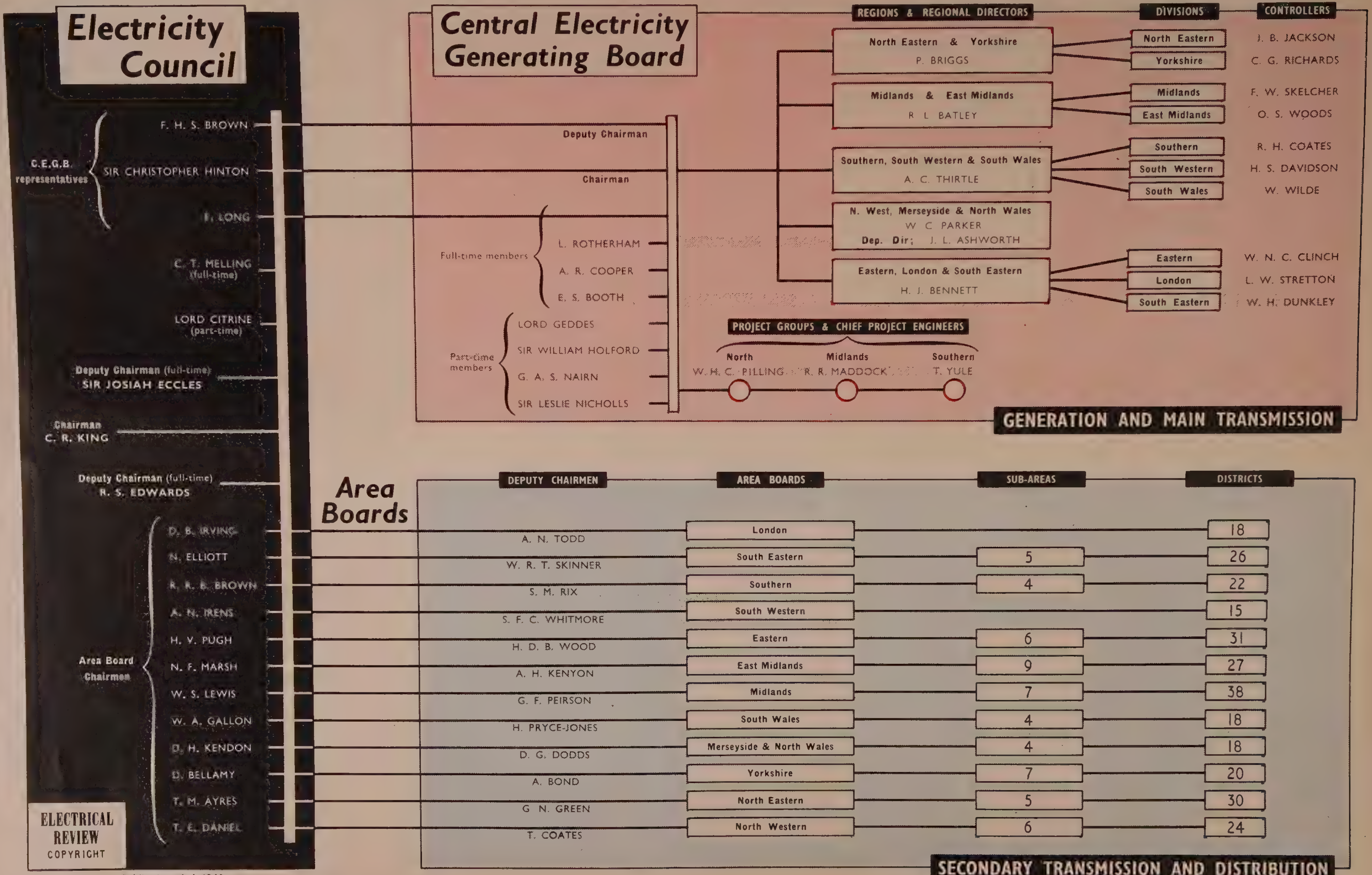
ORGANISATION OF THE ELECTRICITY SUPPLY INDUSTRY



DEPUTY CHAIRMEN	AREA BOARDS	SUB-AREAS	DISTRICTS
A. N. TODD	London		18
W. R. T. SKINNER	South Eastern	5	26
S. M. RIX	Southern	4	22
S. F. C. WHITMORE	South Western		15
H. D. B. WOOD	Eastern	6	31
A. H. KENYON	East Midlands	9	27
G. F. PEIRSON	Midlands	7	38
H. PRYCE-JONES	South Wales	4	18
D. G. DODDS	Merseyside & North Wales	4	18
A. BOND	Yorkshire	7	20
G. N. GREEN	North Eastern	5	30
T. COATES	North Western	6	24

Electrical Review Publications, Ltd. 1960.

companies, Yorkshire Rolling Mills, Ltd., and Low Moor Fine Steels, Ltd., and a director of Brayshaw Furnaces, Ltd., has recently been elected to the board of directors of Low Moor Alloy Steelworks, Ltd.

Mr. A. H. Young, A.M.I.E.E., of Troughton & Young (Lighting), Ltd., has been elected chairman of the Lighting Equipment Development Council in succession to **Mr. W. T. Souter,** of Holophane, Ltd. **Mr. H. H. Ballin,** B.Sc., Ph.D., F.I.E.S., Associate I.E.E., of Atlas Lighting, Ltd., has been elected deputy chairman.

Mr. J. L. Stocks, who for more than fourteen years was the sales manager of the Rawlplug Co., Ltd., has retired. His successor is **Mr. P. D. Northover,** who has been with the company for nearly fourteen years, and who has acted as a technical representative in the North of England. **Mr. L. Unwin,** manager of the Sales Order Department, has been promoted to the position of assistant sales manager to Mr. Northover.

Mr. W. H. Ritchie has been appointed development manager—projects, and **Mr. N. G. H. Thomas** development manager—products, of Monsanto Chemicals, Ltd.

Mr. H. E. Coles, B.Eng.(Hons.), who writes in this issue on "Jet Engine Control" (page 47), served an apprenticeship as an electrical fitter at H.M. Dockyard, Devonport, and, after four years' technical study in the Royal Dockyard School, he took the degree of Bachelor of Engineering (Electronics) at the University of Liverpool. Later he worked as technical assistant in the Systems Department of the De Havilland Engine Co. at Edgware, specialising in automatic control, and at present he is a systems engineer at the Applied Electronics Laboratories, Stanmore, of the General Electric Co., Ltd.

Mr. H. E. Coles

Mr. F. W. H. Shaw, A.M.B.I.M., has been appointed managing director of Submarine Cables, Ltd. (owned jointly by Siemens Edison Swan, Ltd., and the Telegraph Construction & Maintenance Co., Ltd.).

Mr. Shaw, who has been in the cable industry for over forty years, was assistant engineering director of Siemens Edison Swan before joining Submarine Cables, Ltd., in January last year as deputy managing director. He was educated at Woolwich Polytechnic and was appointed assistant to the cable works manager of Siemens Brothers & Co., Ltd., in 1938; from 1947 to 1953 he was chief cable engineer, and general cable manager from 1953 to 1955. He was a director of the St. Helens Cable Co. from 1953 to 1958 and chairman of the C.M.A. Technical Committee for the same period.

Mr. F. W. H. Shaw

Mr. F. S. H. Lemon

Mr. Shaw succeeds **Mr. F. S. H. Lemon,** O.B.E., who retires after over forty years' service. As a member of the electrical staff, Mr. Lemon served on board cableships for twelve years, and took part in the maiden voyage of c.s. *Dominia* in 1926 when she laid the 3,467 nautical mile Vancouver-Fanning Island cable. He was appointed manager of Submarine Cables, Ltd., in 1951 and managing director in 1956. He was responsible for the production of the greater part of the first transatlantic telephone cables at the company's Erith factory in 1955 and 1956.

Sir John Erskine, a member of the North of Scotland Hydro-Electric Board, has been appointed by the Secretary of State for Scotland as deputy chairman of the Board. The appointment will continue until the end of 1961. Sir John, who succeeds the late Sir Hugh Mackenzie, C.B.E., is chairman of the Fairfield Shipbuilding & Engineering Co., Ltd. **Lt.-Col. R. Neilson,** Kinlochbervie, has been appointed a part-time member of the Board for the next three years. **Sir George McLashan,** a member of the Board since 1948, has been reappointed a part-time member and chairman of the Electricity Consultative Council for the North of Scotland District until the end of next year. **Lord Provost W. Hughes,** Dundee, and **Mr. A. I. Mackenzie,** C.A., have been appointed part-time members until the end of 1962.

Sir Maxwell Inglis, Bt., has been appointed a part-time member of the South of Scotland Electricity Board and chairman of the Electricity Consultative Council for the South of Scotland until the end of 1962.

Mr. J. M. L. Slater, M.I.E.E., and a life member of the American Institute of Electrical Engineers, has retired from the position of marine manager of Allen West & Co., Ltd., after sixty years' service in the electrical engineering industry.

Mr. Slater joined the company in 1927 and has worked in intimate touch with the Admiralty, for whom Allen West & Co. manufacture all classes of electric motor control gear. He has, too, been closely identified with the development of control equipment for many of the world's largest ocean-going liners, such as the *Queen Elizabeth.*

Mr. Slater gained experience of mechanical engineering before becoming an electrical draughtsman in 1903. Three years later he joined the engineering staff of the British Westinghouse Co., Ltd., at Trafford Park, where he remained until 1918. For the next four years he was with the Admiralty at Whitehall in charge of switchgear and control gear design under the Director of Electrical Engineering. He represented the Admiralty on the British Standards Institution, and continued his membership until 1926. The new manager of the Marine Department of Allen West & Co., Ltd., is **Mr. G. H. Page,** who has been deputy to Mr. Slater for more than twenty years.

The Prime Minister has accepted an invitation to be the principal guest and speaker at the annual dinner of the **Institute of Metals,** which is to be held at Grosvenor House, London, W.1, on 31st March. The United States Ambassador will reply to the toast of the guests.

Mr. E. Beddow, chief cost clerk, and **Mr. J. A. Perkins,** commutator and core maker, each of whom has been employed at the Bushbury Engineering Works of the Electric Construction Co., Ltd., for half a century, recently received presentations from Mr. J. C. Milne, managing director, to mark the occasion. Both Mr. Beddow and Mr. Perkins received other presentations in their respective departments.

Mr. A. E. Kay has been appointed a director of the London Electric Wire Co. & Smiths, Ltd.

Mr. H. M. Medhurst, who has been in the electrical industry for fifty years, has just retired. He received his electrical education at Finsbury (City and Guilds) Technical College in the days of Dr. Silvanus P. Thompson, and was apprenticed at the Crypto works. After twenty-seven years with the Lancashire Dynamo & Motor Co. he joined Laurence, Scott & Electromotors, Ltd., as sales engineer at the

Mr. H. M. Medhurst (right) receiving good wishes from Mr. J. B. Wormall (industrial sales director of Laurence, Scott & Electromotors, Ltd.), on his retirement after 50 years in the industry

London office, from which position he has retired after twenty-three years. His colleagues at L.S.E. have presented him with a cocktail cabinet.

A.E.I. (Rugby), Ltd., announces the appointment of **Mr. L. C. J. Carvill** as supervisor of purchases. He succeeds **Mr. O. A. Pallett,** who continues with the company in a consultative capacity. On completing an apprenticeship course at the B.T.H. Rugby Works, Mr. Carvill transferred in 1933 to the Works Buying Department, being appointed head of this department in 1949. He moved to the Central Purchasing Office in 1954 as personal assistant to the supervisor of purchases and was promoted deputy supervisor in 1958. He is a member of the National Council of the Purchasing Officers' Association and hon. treasurer of the Coventry Branch.

Mr. L. C. J. Carvill

Mr. E. C. Merrick

Mr. E. C. Merrick, A.C.G.I., A.M.I.E.E., A.M.I.W.M., has been appointed manager of the Education Department of A.E.I. (Rugby), Ltd. He succeeds **Mr. C. Grad,** who has been seconded to other duties in connection with education within the A.E.I. Mr. Merrick joined the British Thomson-Houston Co. in 1927 as a student apprentice, and transferred to the Construction Department, Rugby Works, in 1931. A year later he joined the Production Control Department in the motor factory at Rugby and in 1934 was appointed assistant to the planning engineer. Mr. Merrick became chief planner of the fabrication factory in 1936, assistant chief inspector in 1940 and chief inspector in 1942. After a period as superintendent at the Larne Works, Northern Ireland, he returned to the Midlands as apprentice training supervisor, Electronics Group, Leicester. In May last year he was appointed assistant manager, Education Department, Rugby.

Mr. J. W. E. Stanley has retired from the office of managing director of the Plibrico Co., Ltd., but remains as a director. **Mr. D. E. Huntley,** who has been for many years assistant to Mr. Stanley, has been appointed managing director.

Mr. W. M. Dingley, sales director of Stanley Works (Great Britain), Ltd., Sheffield, has been appointed in charge of a European Marketing Organisation for all products made by the Stanley factories in America, Great Britain and Germany. Mr. Dingley will have headquarters in Zurich from which he will control regional organisations in Northern, Central and Southern Europe and, later, in the Near East.

Mr. G. F. Paveling, shop superintendent of the Uppark Drive factory of the Plessey Co., Ltd., at Ilford, has retired. He had been with the company for over thirty-five years. A greenhouse and refrigerator, subscribed for by Mr. Paveling's colleagues and staff, were presented to him by Mr. E. J. Earnshaw, director of the Plessey Aircraft and Atomic Energy Group.

Foster Wheeler, Ltd., announce the following changes in the board of directors:—

Consequent upon the resignation of **Mr. G. H. Hopewell,** F.C.G.I., M.I.Mech.E., A.M.I.C.E., M.I.Mar.E., F.Inst.F., as managing director, **Mr. C. E. H. Verity,** O.B.E., M.I.C.E., M.I.Mech.E., M.I.E.E., M.I.Mar.E., M.Inst.F., becomes managing director, and will continue as manager of the Steam Division. **Mr. R. B. Kerr,** M.B.E., Grad.I.Chem.E., A.M.Inst.Pet., is appointed deputy managing director and manager of the Process Plants Division. Mr. Hopewell remains a director of the company and becomes deputy chairman. **Mr. H. T. Collinswood** has retired from the post of manager of the Process Plants Division, but remains a director of the company.

A testimonial fund has been opened by the Western Centre of the Institution of Electrical Engineers for **Mr. F. E. Freeling,** who recently retired from the position of hon. secretary of the Centre. Subscriptions (maximum 5s) should be made payable to the hon. treasurer, Western Centre, I.E.E., and sent to Mr. D. J. Thomas, 2, St. Andrew's Place, Cardiff, by 31st January.

Mr. A. J. W. Green, who was elected to the main board following the Braby-Auto Diesels merger, has been appointed joint managing director of the Frederick Braby group of companies.

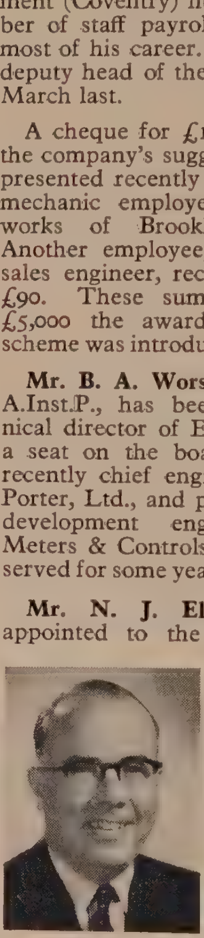
On 22nd December the **Langham Thompson Group** held its annual staff dinner at the Connaught Rooms, London. Mr. J. Langham Thompson was in the chair and he was supported by Mrs. Thompson and Admiral Sir Philip Clarke, both of whom are directors of the Group. The principal guest was Mr. F. B. Duncan, chairman and managing director of Ether, Ltd. In proposing the toast to the guests, Mr. Langham Thompson said that several records had been beaten and that the target of £1 million of sales for the year ending April next would, without doubt, be achieved. He went on to say that the invoiced sales, the profits and the orders in hand were the highest in the history of the organisation. In introducing Mr. Duncan, Mr. Thompson said that as a result of the merger between Ether, Ltd., and the Langham Thompson Group, Mr. Duncan would, with effect from 1st January, become not only a director of the J.L.T. Group but would also be chairman and managing director of the new company arising from the merger, to be known as Ether Langham Thompson, Ltd.

Mr. E. H. French has been appointed head of staff payroll and pensions, A.E.I. (Rugby), Ltd., in succession to **Mr. A. E. Browne,** who retired on 31st December. Mr. French joined the B.T.H. Co. at Rugby in 1925 as an apprentice on a commercial course, and received his training in the Staff Payroll Department. Except for periods in the Accounting Department at Rugby and the Cashiers Department (Coventry) he has been a member of staff payroll and pensions for most of his career. He was appointed deputy head of the department on 1st March last.

A cheque for £190, awarded under the company's suggestion scheme, was presented recently to **Mr. L. Shaw,** a mechanic employed at the Bedford works of Brookhirst-Igranic, Ltd. Another employee, **Mr. A. Pitson,** a sales engineer, received a cheque for £90. These sums bring to nearly £5,000 the awards made since the scheme was introduced in 1948.

Mr. B. A. Worswick, B.Sc.(Hons.), A.Inst.P., has been appointed technical director of Elcontrol, Ltd., with a seat on the board. He was until recently chief engineer of Fischer & Porter, Ltd., and previously was chief development engineer of Bailey Meters & Controls, Ltd., after having served for some years with I.C.I., Ltd.

Mr. N. J. Ellerbeck has been appointed to the board of Remax, Ltd., as deputy managing director. Mr. Ellerbeck has been with Simms Motor Units, Ltd., for the past twenty-eight years and relinquishes the post of commercial manager to take up his new duties. **Mr. J. C. Davies,** general manager of Remax, Ltd., has also been appointed a director of the company.



Mr. N. J. Ellerbeck

The Incandescent Heat Co., Ltd., which is represented in India by A.B.M.T.M. (India), Ltd., is seconding **Mr. B. A. Harper** to the staff of A.B.M.T.M. (India), Ltd., as senior furnace technician (India).

More than a thousand employees witnessed presentations on 23rd December to 256 employees of **Venner, Ltd.,** who have given ten years' or more uninterrupted service to the company. The presentations were made by Mr. E. Tauchert, managing director. The record for length of service is held by Mr. R. G. W. Andrews, works manager, who has been with the company for thirty-nine years.

Mr. C. R. Hatch

Mr. C. R. Hatch, A.M.I.E.E., author of the article on "Arc Furnace Transformers" (page 52), was educated at Clifton College, Bristol, and received his technical education at the Wigan and District Mining and Technical College and the Royal Technical College, Salford. He joined the Metropolitan-Vickers Electrical Co., Ltd., as an apprentice in 1937 and from 1949 until the present time he has worked in their Transformer Engineering Department. He is design engineer for large and medium power transformers, reactors and other equipment made at the Wythenshawe factory.

Lord Chandos, chairman of Associated Electrical Industries, Ltd., is paying a visit to India and has been invited by the Indian Government to see some of the important projects in which Britain is helping industrial development there. He was to leave London by air yesterday (Thursday). Among his activities during his stay in India, Lord Chandos will have meetings with the President, Dr. Prasad, and the Prime Minister, Mr. Nehru, as well as other leading members of the Government, and while in Delhi he will deliver addresses to the Indian Council of World Affairs, the Delhi School of Economics and the Institute of Public Administration. His visits will include the factory site and township of the Government-owned company, Heavy Electricals, Ltd., the Bhakra Dam and power plant, the Indian Government Locomotive Co. at Chittaranjan, and the large steel plant being built at Durgapur by the British consortium ISCON. He will also visit the offices of Associated Electrical Industries (India) Pvt., Ltd., and the A.E.I. Manufacturing Co.'s works. Lord Chandos will be returning from India on 2nd February.

Alderman E. Simms, of Brighton, retired from the South Eastern Electricity Board on 31st December. He had been a part-time member of the Board since its formation in January, 1948.

The annual general meeting of the **E.I.B.A.** Manchester and District Branch will be held on 26th January (5.30 p.m.) at the Engineers' Club, Albert Square, Manchester.

With regard to the note in our last issue relating to the new chairman of the Branch, we were misinformed. **Mr. R. A. Erskine** tells us that he succeeded **Mr. A. W. A. Dick-Cleland** in that position early last year. **Mr. W. H. Smith** is chairman of the Branch Ball Committee.

Mr. C. T. M. Bagnall, who has been publicity manager with the English Electric Co., Ltd., since 1952, has been appointed to the new post of manager, publicity and information services. He will be responsible for both the company's public relations and publicity departments.

This reorganisation follows the retirement of **Mr. J. I. Hall** as the company's public relations officer on 31st December. Mr. Hall remains as a consultant to the group until the end of March, during which period he will spend some weeks on company business in America and Canada. Mr. Hall has resigned from his post to enable him to handle personal and family business.

Four new appointments have been made in the publicity and public relations departments. **Mr. M. B. Schroeder** becomes joint deputy publicity manager (technical) and will continue to work from Stafford. **Mr. C. G. Hollowell,** who has been publicity manager of D. Napier & Son, Ltd., since 1955, is appointed to the parent company as joint deputy publicity manager (general), working from Marconi House, London. In the public relations department, **Mr. E. C. Roberson** will be deputy to Mr. Bagnall on public relations matters, and will continue to be responsible for the company's press relations in the atomic power field. **Miss Patricia Hardie,** who joined the press office in 1951, is appointed chief press officer.

Mr. A. E. Bates, M.I.E.E., has been appointed manager of the English Electric Co.'s office in Edinburgh. He succeeds **Mr. W. M. Todd,** who was recently transferred from Edinburgh to manage the company's Bristol office.

Mr. A. E. Bates

Mr. Bates joined the company in 1926 in the switchgear drawing office at Stafford. He moved from the switchgear sales and contracts office to Manchester as sales engineer in 1932, becoming chief of meter sales and contracts at Stafford in 1937 and then technical sales engineer in London where he has been principally concerned with applications of protective gear equipment and metering.

Mr. E. W. Raby, F.I.M.T.A., F.S.A.A., deputy chief accountant of the Yorkshire Electricity Board, is retiring on 31st January. Immediately before his appointment as an assistant chief accountant in 1948, Mr. Raby was borough treasurer of Brighouse, having previously served in the Treasurer's Departments of various local authorities including Heywood (Lancs.), Bingley, Lytham St. Annes and Barrow-in-Furness.

Mr. Raby will be succeeded by **Mr. A. Dent,** D.P.A., F.S.A.A., A.I.M.T.A., the Board's organisation and methods officer. Mr. Dent was an assistant chief accountant with the Board before his appointment as organisation and methods officer. He commenced his service with the Board in 1948 and was previously deputy borough treasurer of Ipswich. He had also served in the Treasurer's Departments at Sheffield, Nelson, Gloucester and Stockport.

Sir Alexander Sim has resigned from the position of chairman of W. T. Henley's Telegraph Works Co., Ltd., and director of the subsidiary and certain associated companies. To fill the vacancy **Dr. J. N. Aldington,** a director of the company, has been appointed chairman.

Sir Alexander Sim

Dr. P. Dunsheath

Sir Alexander Sim joined Henley's in June, 1957, after a business life of some twenty-six years spent in India, where he had been chairman of Andrew Yule & Co., Ltd., president of the Associated Chambers of Commerce of India and president of the Bengal Chamber of Commerce and Industry. Returning to this country in 1956, he became a director of Yule, Catto & Co., Ltd., before joining Henley's as a director. He became chairman of the company in 1958, and during his period of office completed the negotiations which resulted in Henley's integration with the A.E.I.

Dr. P. Dunsheath, O.B.E., M.A. (Cantab.), D.Sc. (Eng.), F.Inst.P., M.I.C.E., M.I.E.E., has retired from the board of W. T. Henley's Telegraph Works Co. after forty years with the company. He joined Henley's as chief of the research department in 1919 after distinguished service as a captain in the Royal Engineers during the 1914-18 war. His first task in Henley's was the organisation of the research laboratories and, as chief of research, he was responsible for many developments in high voltage cables. In 1924 he was awarded the Medal of the Royal Society of Arts for his paper on "Science in the Cable Industry." He was appointed research and technical manager of Henley's in 1929 and chief engineer in 1934, being elected to the board of directors in 1937. Upon his retirement from the position of chief engineer in 1946 he was retained as consulting engineer to the company.

In 1945-46 Dr. Dunsheath was President of the Institution of Electrical Engineers. He was twice a member of the Council of the I.E.E., serving as chairman of the Transmission Section in 1936-37 and as vice-president from 1940 to 1943. In 1942 he was appointed chairman of the Research Committee and was re-appointed vice-president in 1945. He was awarded the Kelvin Premium, the John Hopkinson Premium and various Extra Premiums.

Dr. Dunsheath has served on many technical committees, both British and international. In 1927 he visited the United States as a delegate of the International Electrotechnical Commission and in 1957 he was president of the I.E.C. when it visited the U.S.S.R. He has always been keenly interested in the problems of education, particularly in so far as they relate to industry. In 1949 he was elected chairman of the Convocation of the University of London and in 1955 he had the privilege of receiving the Queen Mother and declaring her elected as Chancellor of the University. Within the Henley organisation he founded the Henley Education Scheme some twenty years ago and has been actively engaged, as chairman of the Education Committee, in its development.

Mr. E. A. W. Spreadbury, M.Brit.I.R.E., was elected chairman of the Radio Trades Examination Board at its annual general meeting held on 30th December in succession to **Mr. E. M. Lee,** B.Sc., M.I.E.E. (Belling & Lee, Ltd.). Mr. Spreadbury, who represents the Brit.I.R.E. on the Council of Management of the Board, has been associated with the Board since 1943 when he was appointed an examiner and a member of the Examinations Committee. Subsequently he became a member of the Committee which drafted the scheme of examination in television work, the first examination being held by the Board in 1950. In recognition of this work, he was elected to the Council of Management of the Board in 1947, whilst continuing to serve on the Education Committee. Mr. Spreadbury has been connected with the radio industry since 1922. He joined the staff of the *Wireless & Electrical Trader* in 1937 and is now the technical editor of that journal.

Mr. J. C. Greig has been appointed sales director of the Jacobs Manufacturing Co., Ltd., and Frank Guylee & Son, Ltd., Sheffield.

OBITUARY

Mr. A. B. Hulme.—The death occurred recently of Mr. Arnold Barnett Hulme, managing director of Hulme & Son (Derby), Ltd., electrical engineers, domestic appliance, radio and television dealers, of Sadler Gate, Derby, and Bridge Street, Belper, at the age of sixty-nine. He had been connected with the business for fifty years and was the fifth generation in the firm since it was established in 1843.

Mr. John William Davies, former works director of the Hollinwood works of Ferranti, Ltd., died on 28th December, aged seventy-nine. Mr. Davies, who had retired to Colwyn Bay, joined Ferranti, Ltd., in 1898 in the toolroom, was promoted foreman, then departmental works manager and in 1924 became general works manager. He was elected to the board of directors in 1942. Mr. Davies was a founder member of the Institution of Production Engineers and a past-president of the Manchester district of the Engineering Employers' Association.

The late Mr. P. R. Coursey

Mr. P. R. Coursey.—The death occurred on 3rd January at his home at Headley Down, Hants, of Mr. Philip Ray Coursey, B.Sc. (Eng.), M.I.E.E., F.Inst.P., consulting electrical engineer and a director of the Dubilier Condenser Co. (1925), Ltd. Mr. Coursey who was born in London in 1892, was educated at University College, London, where he was an assistant to Sir Ambrose Fleming. From 1915 to 1918 he was an Admiralty inspector of wireless telegraphy in H.M. Auxiliary Patrol and he was then a technical research assistant at H.M. Signal School. After a period with Wireless Press publications (1920-23) he became chief engineer of the Dubilier Condenser Co. and later technical director, a position which he held until 1957.

Mr. Coursey was the author of a number of books on radio-telegraphy and telephony, electrolytic condensers, etc., and had over fifty patents to his credit.

Mr. W. Dixon.—Merz & McLellan announce the death of Mr. William Dixon, after a very brief illness, on 31st December. He had been a partner since 1937 and for many years the senior partner at their Newcastle-upon-Tyne office.

Mr. C. Burden.—The death occurred on 27th December of Mr. Charles Burden, who for over forty years was manager of J. & T. Robinson, electrical engineers, Croydon. He was seventy-four.

Mr. Norman T. Smith, borough electrical engineer of Warrington from 1939 to 1948, died suddenly in Phœnix, Arizona, on 27th December at the age of fifty-nine. Before going to Warrington Mr. Smith was for seventeen years with the Shropshire, Worcestershire & Staffordshire Electric Power Co., was county electrical engineer to Kirkcudbright County Council for three years and electrical engineer at South Shields for three years. On vesting day he was appointed manager of No. 2 Sub-Area, Merseyside and North Wales Electricity Board, and the following year was appointed general manager of the Nova Scotia Light & Power Co.

Railway Electrification Conference

The organisers of the British Railways Electrification Conference, to be held in London in October, have decided that overseas delegates should be given facilities for visiting manufacturers' works in the week preceding the conference as well as in the week following the conference, i.e., in the weeks 26th September to 30th September and 10th October to 14th October inclusive. A booklet containing details of manufacturers offering facilities for works visits will be sent to each delegate with the preliminary papers. Firms wishing their names to be included should notify the B.E.A.M.A. Publicity Department before the end of this month. The B.E.A.M.A. would also like to hear from firms who have films of interest to the railway industry, which could be exhibited during the conference.

New Generating Plant

During the past twelve months the Central Electricity Generating Board installed 1,775 MW of new generating plant, which represents an additional electrical output capacity of 1,670 MW. Altogether 21 turbo-generators and 23 boilers were involved and these were installed in 15 power stations, five of which were new. In next week's issue we will publish full details of all the new generating plant installed during 1959.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £186 0s 0d
COPPER, H.C. Electro	ton £253 10s 0d
Fire Refined 99·70%	ton £252 0s 0d
Fire Refined 99·50%	ton £251 0s 0d
COPPER Tubes ..	lb 2s 5⅜d
Sheet	ton £286 5s 0d
H.C. wire and strip	ton £306 15s 0d
LEAD, English ..	ton £74 15s 0d
Foreign	ton £73 0s 0d
MERCURY	flask £71 10s 0d
TIN, block (English) ..	ton £787 10s 0d
ZINC, G.O.B. Foreign	ton £95 5s 0d
BRASS Tubes (solid drawn)	lb 2s 0⅜d
Wire	lb 2s 10⅛d
PHOSPHORBRONZE Wire	lb 4s 3⅛d
PLATINUM ..	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 34½d—34¾d

NEW YEAR HONOURS

WHILE the electricity supply industry is poorly represented in the New Year Honours announced last week, many well-known men in the electrical and allied industries are included in the List, and we give their names below:—

Sir George Nelson, Bt., chairman of the English Electric Co., Ltd., is elevated to the peerage as a baron.

Sir George Nelson

Among the new knights are **Mr. J. F. Lockwood,** chairman of Electric & Musical Industries, Ltd., and **Mr. A. B. Waring,** chairman and managing director of Joseph Lucas (Industries), Ltd.

Mr. A. W. Knight, Chief Commissioner of the Hydro-Electric Commission, State of Tasmania, is appointed a Companion of the Order of St. Michael and St. George (C.M.G.), and **Mr. R. J. P. Harvey,** C.B., M.A., Deputy Director-General, General Post Office, becomes a Knight Commander of the Order of the British Empire (K.B.E.).

C.B.E.

New Commanders of the Order of the British Empire (C.B.E.) are **Mr. D. D. Cruickshank,** E.D., B.Sc., M.I.C.E., general manager, Renfrew, Dalmuir and Dumbarton Works, Babcock & Wilcox, Ltd.; **Mr. L. J. Davies,** M.A., B.Sc., M.I.E.E., director of research and education, A.E.I. (Rugby), Ltd., Rugby; **Mrs. Elsa Dunbar,** member of the London Electricity Board; **Mr. S. Green,** A.M.I.E.E., M.I.Prod.E., managing director, Remploy, Ltd.; **Mr. A. J. Nicholas,** O.B.E., A.M.C.T., M.I.E.E., managing director, South Wales Switchgear, Ltd.; **Mr. H. T. Ramsay,** M.Sc.(Eng.), M.I.E.E., F.Inst.P., Director, Safety in Mines Research Establishment, Ministry of Power; **Mr. F. Williams,** B.Sc., M.I.E.E., Controller, Sound Broadcasting Engineering, B.B.C.; **Mr. J. Sharples,** B.Sc.(Eng.), M.I.E.E., general manager and deputy chairman, Central Electricity Board, Federation of Malaya; and **Mr. W. Stubbs,** M.C., M.I.E.E., Director-General of Telecommunications, Federation of Malaya.

O.B.E.

Officers of the Order (O.B.E.) include **Mr. T. Barlow,** resident engineer, Windscale Works, Cumberland, United Kingdom Atomic Energy Authority; **Mr. A. W. H. Cole,** A.M.I.E.E., manager, Communications Division, Marconi's Wireless Telegraph Co., Ltd.; **Mr. E. J. Timberlake,** Associate I.E.E., joint managing director of the Electro Dynamic Construction Co., Ltd.; and **Mr. J. E. Whittaker,** B.Sc.(Eng.), M.I.E.E., Assoc.I.Mech.E., M.Inst.F., manager, Aberdeen Area, North of Scotland Hydro-Electric Board.

M.B.E.

New Members of the Order (M.B.E.) include **Mr. A. Allen,** chief development engineer, Cossor Radar & Electronics, Ltd.; **Mr. W. Atkinson,** D.C.M., M.M., B.E.M., Electrical Engineer, War Office; **Mr. N. Berryman,** chief national savings liaison officer for the electricity supply industry; **Mr. A. G. W. Cannon,** A.M.I.Prod.E., manufacturing manager, Motor and Control Gear Division, Associated Electrical Industries, Ltd., Rugby; **Mr. R. W. Chandler,** chief telecommunications superintendent, G.P.O.; **Mr. J. V. Cross,** mechanical and electrical engineer, Air Ministry Directorate-General of Works, London Airport; **Mr. A. Draper,** B.Sc.(Eng.), M.I.E.E., vice-principal, Rugby College of Engineering Technology; **Mrs. O. M. Edwards,** personnel manager, Radio & Allied Industries, Ltd.; **Mr. L. G. Fowell,** executive engineer and general manager, Pye, Ltd., West Drayton, Middx.; **Mr. M. H. Hall,** engineer-in-charge, television studios, B.B.C.; **Mr. D. A. Hewetson,** telecommunications technical officer, Grade I, Ronaldsway Airport, I. of M.; **Mr. E. J. Hocking,** electrical manager, Vosper, Ltd.; **Mr. W. H. Hughes,** assistant chief financial officer, South of Scotland Electricity Board; **Mr. J. H. Kirk,** executive engineer, G.P.O.; **Mr. W. J. Marshall,** senior executive engineer, Engineer-in-Chief's Office, G.P.O.; **Captain A. S. Mosley,** Master, s.s. *Cliff Quay*, C.E.G.B.; **Mr. N. G. Payne,** A.M.I.E.E., engineer-in-charge of the I.T.A. station at Tamworth, Staffs.; **Mr. G. H. Prince,** head of the Apparatus Engineering Department, Ericsson Telephones, Ltd.; **Mr. J. Ringland,** assistant manager, Electrical Department, Harland & Wolff, Ltd., Belfast; **Mr. P. C. Shaw,** chief electrical engineer, M.S. *Dominion Monarch*; and **Mr. T. A. Yates,** electrical engineer, Admiralty.

B.E.M.

Awards of the British Empire Medal (B.E.M.) have been made to the following:—**Mr. N. Caffrey,** chargehand electrician's mate, Royal Ordnance Factory, Chorley, Lancs.; **Mr. J. F. Connolly,** senior foreman, Davidson & Co., Ltd., Belfast; **Mr. W. Gaddes,** foreman fitter, Carlisle power station, North West, Merseyside and North Wales Region, C.E.G.B.; **Mr. W. S. Harffey,** general foreman, Eastbourne District, South Eastern Electricity Board; **Mr. J. Hartigan,** Technician I, Euston telephone exchange, G.P.O.; **Mr. J. Law,** senior installation inspector, North Eastern Electricity Board (York); **Mr. F. A. Loomes,** technical officer, Research Station, G.P.O., Uxbridge, Middx.; **Mr. J. C. Mathieson,** foreman, Carron Company, Stirlingshire; **Mr. J. B. Raitt,** progress chaser, Keith, Blackman, Ltd., Arbroath; **Mr. W. T. Robinson,** fitter (mechanical), Dunston "B" power station, North Eastern Division, C.E.G.B.; **Mr. H. Smith,** shift superintendent, British Aluminium Co., Ltd., Falkirk; **Mr. W. A. Smith,** technical officer, Telephone Manager's Office, Aberdeen; **Mr. E. Taylor,** foreman, Automatic Telephone & Electric Co., Ltd., Liverpool; **Mr. W. Thompson,** foreman meter reader and collector, Yorkshire Electricity Board, Leeds; and **Mr. A. H. D. Trengove,** foreman, North Western Electricity Board, Bolton.

Mr. J. F. Lockwood

Mr. A. B. Waring

Mr. D. D. Cruickshank

Mr. L. J. Davies

Mr. A. J. Nicholas

Mr. A. W. H. Cole

Mr. E. J. Timberlake

Mr. A. G. W. Cannon

Financial Section

STOCKS and SHARES

ENCOURAGED by the optimistic tenor of many investment reviews of 1960 prospects, the industrial markets of the Stock Exchange got away to a flying start in the New Year. Whether this pace can be sustained is being questioned seriously enough to induce periodical bouts of profit taking, and some consequent irregularity of price movements, but at the beginning of this week the buyers were still strongly in the ascendant. They have continued to act upon the new-found preference for shares in the capital equipment sides of industry, as opposed to those in the consumer goods categories which made the running throughout most of the past year. Some of the best of recent advances have been recorded among the major electrical groups and the heavy engineering firms associated with them.

Capital Equipment Shares

Good improvements took place in almost all the leading shares in the electrical market. A.E.I. at 66s 3d and G.E.C. at 47s 6d gained 5s 9d and 4s 3d respectively during the week, and English Electric added 2s to previous advances in reaching 53s. Crompton Parkinson at 15s were marked ex- the scrip issue. A. Reyrolle rose 3s 6d to 98s 6d and C. A. Parsons 3s 9d to 58s 9d. In the heavy engineering sections, Head Wrightson at 31s 6d, Clarke Chapman at 58s 6d and J. Thompson at 26s were all about 3s to the good. Babcock & Wilcox moved up further to 48s 3d and Simon-Carves to 37s 6d. Advances in Richardsons Westgarth and International Combustion further testified to the revival of confidence in the outlook for the capital industries, and the rise in Tube Investments continued up to 139s.

Higher Prices

In the cable manufacturing group B.I.C.C. were marked up by a further 1s 6d to 60s 6d while there were sharp advances of 5s each in Johnson & Phillips to 23s 9d and in Reliance Clifton to 27s 6d. Ericsson at 27s 9d were a firm point in the telephone section. Elsewhere Chloride Electrical were again strongly favoured and rose 4s to 73s, but Lucas at 74s 6d lost 4s of the previous big gains. Lancashire Dynamo also came back 1s, to 64s, but were still some 15s above the price ruling before the announcement of Metal Industries' bid for the shares. Brook Motors were firm at 58s 6d after the appearance of the full report and Colvern put on 3s to 40s 6d following the directors' indication of an increase in this year's dividend. Goblin (B.V.C.) made a good start under their new name, rising 2s 6d to 13s 9d; the company's annual results are expected to be announced during this month.

Dimplex

The public offer of 300,000 Dimplex 5s ordinary shares a week before

Price Changes in

Company or Board	Nom. Value	Middle price 4th Jan.	Week's Rise or Fall	Dividend Pre-vious	Dividend Last	Yield %	1959 High-est	1959 Low-est
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	79½	+½	3	3	3 15 6	81	77¼
Brit. Elec. 1974/77	100	76½	+½	3	3	3 18 6	78	74¼
Brit. Elec. 1976/79	100	79½		3½	3½	4 8 0	81	77½
Brit. Elec. 1974/79	100	90½	+½	4¼	4¼	4 14 0	91½	87½
Overseas Electric Supply								
Calcutta Elec.	£1	19/6		6·8†	7†	11 9 6	20/-	16/-
East African Power	£1	20/-		7½	8	8 0 0	22/6	19/3
Nigerian Elec.	£1	19/-	+1/-	8	8	8 8 6	19/-	13/-
Perak Hydro-Elec.	£1	17/-		10	5	5 17 9	17/-	12/3
Electrical Shares								
Aberdare Holdings	5/-	17/9		17½	17½	4 18 6	18/9	15/6
Aerialite	1/-	9/3	+6d	54	54	5 16 6	12/3	7/9
Allen, W. H.	£1	58/9	+2/6	11	12	4 1 9	58/9	43/-
Allied Insulators	5/-	23/-		—	20‡	4 7 0	23/6	18/9
Anglo-Portuguese Tel.	£1	28/6	−6d	9	9	6 6 3	30/9	26/6
Aron Elec. Ord.	£1	45/-		15	15	6 13 3	62/6	45/-
Assoc. Elec. Ord.	£1	66/3	+5/9	15	15	4 10 6	67/-	53/9
Automatic Tel. & El.	5/-	21/9	+6d	17	17‡	3 18 0	21/9	18/-
Babcock & Wilcox	£1	48/3	+1/9	13¾	13	5 8 0	52/6	43/-
Bakelite	10/-	41/3	+2/3	15	15	3 12 9	41/3	22/-
Baldwin, H. J.	2/-	2/3		20	—	—	3/-	2/-
Berry's Electric	5/-	32/6		10	20‡*	3 1 6	33/6	7/3
Bowthorpe Holdings	2/-	11/3	+9d	25	27	2 17 9*	11/3	8/-
British Elec. Traction:								
Def. Ord. " A "	5/-	49/6	+2/-	25	35	3 10 9	49/6	35/6
B.I. Callender's	£1	60/6	+1/6	12½	13½	4 9 3	60/6	44/9
B.I. Callender's 6% Pref. ...	£1	21/-		6	6	5 14 3	21/-	19/9
British Thermostat	5/-	25/-	+2/-	30	35	3 10 0*	28/-	18/6
Brook Motors	10/-	58/6	+1/-	25	25*	4 5 6	59/6	46/-
Bulgin, A. F.	1/-	13/9		45	50	3 12 9	13/9	6/9
Bulpitts	5/-	21/3	+9d	—	15	3 10 6	21/3	10/-
Burco Dean	5/-	16/3	−3d	16	18	5 10 9	19/6	12/3
Cable & Wireless:								
Ord.	5/-	20/9	+2/-	10	10*	2 8 3	22/-	12/3
4% Loan	100	96		4	4	4 3 3	96	93
Chloride El. Storage " A " ...	£1	73/-	+4/-	17½	20‡	3 12 6*	73/-	43/8
Clarke Chapman	£1	58/6	+3/6	27½	13¾*	4 14 0	66/3	52/6
Cole, E. K....	5/-	27/6		17½	20	3 12 9	27/6	17/3
Contactor Switchgear	5/-	15/6		14	14	4 10 3	16/9	12/-
Cossor, A. C.	5/-	10/-	+9d	Nil	5	2 10 0	9/6	6/3
Crabtree	10/-	54/-		20	20	3 14 0	54/-	28/-
Crompton Parkinson	5/-	15/-x.c.	+6d	12	14	3 14 9*	15/-	9/6
Davis & Timmins	5/-	21/9		18	20	4 12 0	22/-	14/6
De La Rue	10/-	71/6	+2/-	17½	20	2 16 0	71/6	30/3
Decca " A "	10/-	50/6		50	20*	3 19 3	50/6	33/3
Desoutter	5/-	37/6		25	21⅔*	2 18 0	37/6	19/-
Dewhurst	2/-	8/6x.d.		20	20	4 14 3	9/6	7/3
Dictograph Tel.	2/-	13/6	+1/9	20	20	2 19 3	13/6	7/-
Dimplex	5/-	29/-	−1/-	—	25‡	4 6 3	30/-	—
Dubilier Condenser	1/-	5/3		20	25	4 15 3	5/6	3/3
Duport	5/-	28/6	+1/3	12½	17½	3 1 6	28/6	10/3
E.M.I.	10/-	56/3	+2/3	20	14*‡	2 9 9	56/6	31/6
Electrical Apparatus	5/-	14/3		14½	14½	5 1 9	16/6	13/-
Electrical Components	5/-	12/6		12½	15	4 0 0*	14/-	7/-
Elec. Construction	£1	37/-	+1/-	8½	9	4 17 3	37/-	27/9
Elliott-Automation	5/-	27/6	+1/3	—	11·2‡	2 0 9	30/6	16/9
Enfield Rolling Mills	£1	56/3	−9d	12½	15	5 6 9	60/-	36/9
English Electric	£1	53/-	+2/-	14	14	3 10 9*	52/6	37/10
English Electric 3¾% Pref. ...	£1	13/3	−3d	3¾	3¾	5 13 3	13/6	12/3
Ericsson Tel.	5/-	27/9	+1/6	12†	13†	3 16 0	28/-	22/3
Ever Ready	5/-	28/6	+1/-	20	27½‡	2 18 0*	28/-	13/3
Falk Stadelmann	£1	35/-		10	10	5 14 3	35/6	25/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

Christmas met with a tremendous response, and they have since been actively dealt in about 10s above the issue price of 19s. According to the prospectus, the company began in 1949 to concentrate on its electric radiators and has since extended the range of products. Profits in this decade expanded from under £10,000 to over £200,000. In the first months of the current year, which runs to June, sales and profits increased, and for the whole period the directors estimated earnings at not less than £225,000. On that basis the intended dividend of at least 25 per cent, on capital of £250,000, would be covered more than 2¾ times over. At their present price the minimum prospective yield on the shares is a little under 4½ per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 4th Jan.	Week's Rise or Fall	Dividend Pre-vious	Dividend Last	Yield %	1959 High-est	1959 Low-est
Electrical Shares—continued						£ s d		
G.E.C.	£1	47/6	+4/3	10	10	4 4 3	48/-	31/3
G.E.C. 6½% Pref.	£1	23/-		6½	6½	5 13 0	23/-	20/3
General Cables	5/-	9/-		24	15	8 6 9	9/3	7/6
Goblin (B.V.C.)	5/-	13/9	+2/6	10	7½*	2 14 6	13/9	4/6
Greenwood & Batley	£1	117/6	+1/3	20	20	3 8 0	117/6	75/-
Hackbridge Holdings	5/-	16/9	+6d	20	20	5 19 6	19/3	14/3
Hackbridge & Hewittic	5/-	14/9	+1/-	20	20	5 1 9*	15/6	10/6
Head Wrightson	5/-	31/6	+3/-	20	14‡*	2 4 6	31/6	16/6
Heatrae	2/-	9/6		20	20	4 4 3	10/-	7/6
Holophane	5/-	19/6	+9d	22½	26	6 13 3	20/-	14/9
Hoover	5/-	103/9		50	60	2 17 9	103/9	55/-
I.C.I.	£1	61/6	+1/6	12	8*	2 11 9	61/6	33/-
Intl. Combustion	5/-	45/-	+3/-	25	30‡	3 6 9	43/6	29/9
Intl. Computers & T.	£1	77/-	+2/9	—	10	2 12 0	78/9	57/6
Johnson & Phillips	£1	23/9	+5/-	5	5	4 4 3	30/6	18/3
Lancashire Dynamo	£1	64/-	−1/-	11	12½‡	—	65/-	31/6
Laurence Scott	5/-	18/6	+6d	15	15	3 9 9*	18/9	14/-
Lister, R. A.	£1	55/6		12½	14	5 0 9	55/6	32/9
Lucas, J.	£1	74/6	−4/-	10	12½	3 7 3	78/6	43/3
Marconi Marine	£1	43/-		10	10	4 13 0	48/6	40/-
Marryat & Scott	2/-	14/9	+6d	37½	22½*	3 1 0	14/9	8/6
Mather & Platt	£1	52/-		15	10⅜*	4 2 0	52/-	41/3
Metal Industries	£1	74/6		14	15‡	4 0 6	74/6	39/9
Midland Elec. Mfg.	£1	52/6	+9d	12½	10*	3 16 3	52/6	41/6
Morphy-Richards	4/-	33/9	+6d	20	25	2 19 3	34/-	18/-
Murex	£1	76/-	+2/-	17½	15	3 19 0	76/-	42/-
Newman Ind.	2/-	4/-	+6d	10	10	5 0 0	3/6	2/3
Oldham & Son	1/-	2/9		17½	17½	6 7 3	3/3	2/6
Parsons, C. A.	£1	58/9	+3/9	7½	8⅛‡	2 15 6	58/9	45/9
Philips' Lamps	Fl.10	160/-	+2/6	14	14	1 3 0	160/-	88/-
Plessey	10/-	48/6	+1/-	20	14*‡	2 17 9	48/6	23/6
Pye	5/-	19/-		12½	12½*‡	3 5 9	20/6	13/-
Pyrotenax	5/-	44/9		—	34	3 16 0	47/6	33/9
Radiation	£1	43/9	+3/9	5	6	2 14 9	43/9	24/9
Reliance Clifton	5/-	27/6	+5/-	15	15	2 14 6	27/6	17/6
Reyrolle	£1	98/6	+3/6	17½	17½	3 11 0	98/-	85/9
Rheostatic	4/-	18/6	+3d	12½	20‡	4 6 6	18/6	8/3
Richardsons Westgarth	10/-	14/9	+6d	8⅓	8⅓	5 13 0	15/3	11/6
Simon-Carves	5/-	37/6	+2/6	25	25	3 6 9	37/6	28/6
Smith (England), S.	4/-	20/-	+6d	12½	17½	3 10 0	21/-	11/6
Southern Areas	£1	14/9	+9d	Nil	Nil	Nil	15/-	10/6
Strand Elec.	5/-	19/3	+1/6	15	20	5 4 0	19/3	8/6
Sturtevant	5/-	23/-	+1/-	15†	15†	5 6 6	23/6	17/-
Sun Elec.	5/-	15/9		25	15*	4 15 3	16/9	8/3
Switchgear & Cowans	5/-	16/6	+1/-	22½	15*	4 11 0	16/6	10/3
T.C.C.	10/-	57/6		25	25	4 7 0	58/6	38/-
Telephone Mfg.	5/-	7/-		10	10	7 2 9	7/3	4/9
Telephone Rentals	5/-	19/6	+3d	12½	12½*	3 4 0	22/6	11/9
Thompson (John)	5/-	26/-	+3/-	25	25	4 16 3	25/6	19/6
Thorn Elec.	5/-	55/6	−9d	17½	20	1 16 0	56/3	26/3
Thornycroft	£1	31/6	+3/-	7½	6	3 16 3	31/6	20/6
Tube Investments...	£1	139/-	+4/6	17½	20	2 17 6	138/-	71/6
Vactric	5/-	42/6	−6d	25	37½	4 8 3	46/6	26/3
Veritys	5/-	1/6		2½	—	—	5/-	1/3
Walsall Conduits	4/-	15/9	+1/-	22½	22½	3 5 0*	15/9	10/8
Ward & Goldstone	5/-	58/9	+1/3	25	30	2 11 0	58/9	30/6
Watford	2/-	11/6		25	25*	4 7 0	14/9	7/6
Westinghouse	£1	59/-	+1/-	10	10	3 7 9	59/-	39/6
West, Allen	5/-	15/6	+1/-	12½	11⅜*	3 16 9	15/6	11/9
Wolf Electric	5/-	11/9	+1/3	10	10	4 5 0	11/9	7/9

Automatic Telephone

Automatic Telephone & Electric have now completed their capital reorganisation plan, the main features of which were the amalgamation of the three former of classes of deferred and ordinary stock; a capitalisation issue of £190,000 in ordinary shares, of which £100,000 went to B.I.C.C. as compensation for the loss of special voting rights; and the subdivision of the nominal value of the shares from £1 to 5s. Interim dividends of 5 per cent are being paid, and the directors indicate a final of 12 per cent next July on the reorganised capital, but not on the scrip issue. In the new form the 5s shares have been dealt in lately at about 21s 9d, so that the prospective yield is a fraction under 4 per cent.

Firth Cleveland

Among the most striking of recent performances in the industrial market is the rise in Firth Cleveland 4s shares, which were the subject of a public offer last July at a price of 16s 6d. They were quoted at 23s 6d about a month ago, and have since risen to double that figure, subsequently coming back a little to 44s 6d. These latest movements came as a sequel to the announcement of two major acquisitions by the company, the first of Broadmead, Ltd., retailers of radio, electrical and domestic appliances, and the second of the Solartron Electronic Group, makers of electronic instruments for industrial uses and of other equipment. The second deal means the creation of a new Instruments and Electronics Division in the Firth Cleveland group. At the time of the marketing of the shares the directors envisaged ordinary dividends totalling 24 per cent, of which 10 per cent has now been paid as an interim distribution.

Dictograph Telephones

The 2s shares of Dictograph Telephones have risen very strongly, to about 13s 6d, since publication of the results for the year ended in August, during which the net profit expanded by more than a half, to £150,000 (after tax). The dividend remains unchanged for the third time at 20 per cent, but now has three-fold cover by earnings, and in the balance sheet the reserves are considerably larger than the £375,000 ordinary capital. The last scrip issue was a one-for-four share distribution in 1957, after which the rate of the dividend was maintained on the increased capital. In his review, the chairman spoke well of the order book and present sales.

REPORTS and DIVIDENDS

Brook Motors, Ltd.—The main figures in the accounts for the year to 30th September last were given in our issue of 18th December, together with the proposal to make a further issue of ordinary shares.

With the report and accounts now issued, Mr. F. V. Brook (chairman and joint managing director), in reviewing the past year, says that after sharing in the general trade recession, resulting in a substantial drop in profits over the first half of the year, a considerable improvement in demand during the final six months helped the turnover substantially, almost to the level of the previous year's achievement. At the moment, with the revival continuing in most industries, the demand for their products is exceedingly good, but he says that with the abandonment of price agreements there is a general move by many companies to obtain a larger share of the available demand by reducing prices and competition will be keen. This can only result in everyone finding difficulty in maintaining profit margins unless substantially greater turnover figures are obtained. Other circumstances affecting the position would be the possibility of increased labour and material costs if present demands for higher wages and shorter hours are granted.

The company enjoys a substantial direct export trade, not the least of which is through the subsidiary companies in both the United States and Canada. The former now contributes satisfactorily to the overseas demand and is self-supporting. The Canadian company has exceeded expectations in its first year of operation, and providing the present trend continues the company will soon be playing an important part in the direct export sales. The other overseas markets have shown varying conditions. Whilst a decline has been experienced in some traditional markets, increased demand came from unexpected quarters, resulting in a general improvement in direct export sales. In recent months an improvement has been noted for most markets. The extension to the fractional horse power motor factory is now completed.

At present there is an upward trend in demand and every sign that this will continue.

Hartley Baird, Ltd.—Mr. A. W. M. Hartley (chairman) presided at the annual meeting held on 29th December. In his circulated statement he said that the net profits for the past year were considerably increased; moreover, they did not include any contribution from the Baldwin group. Trading in the current year, both in the original Hartley Baird group and in Baldwin's, was ahead of the preceding year.

Dealing with the operating companies, the chairman said that sales by Hartley Electromotives, Ltd., exceeded the £1,000,000 for the first time, but there was a lowering of profit margins. Despite the difficulties of the cable-making industry, Duratube & Wire, Ltd., had the most profitable year in its history. The volume of work completed in 1958-59 by Hartley Installations, Ltd., was satisfactory, and in the current year the volume of work in hand had increased.

Firth Cleveland Solartron Acquisition.—Firth Cleveland, Ltd., is acquiring a controlling interest in the Solartron Electronic Group, Ltd., by subscribing for 300,000 new ordinary shares of 10s each at £3 per share and by acquiring from existing shareholders an additional 125,000 ordinary shares, the consideration per Solartron share being, at the option of the shareholders, either £3 in cash, or the allotment of two ordinary shares of 4s each in Firth Cleveland. Mr. C. W. Hayward (chairman) and Mr. G. Harries (secretary) of Firth Cleveland will join the Solartron board, and Mr. Hayward has agreed to accept the chairmanship of Solartron. Mr. J. E. Bolton will be deputy chairman and managing director.

As a first step to the new arrangements, an extraordinary meeting of Solartron is being convened on 14th January, to increase the company's issued capital to £600,000 by the creation of 300,000 new ordinary shares of 10s each, to be subscribed for by Firth Cleveland at £3 each.

The Plessey Co., Ltd.—The annual meeting was held on 30th December, Mr. A. G. Clark (chairman and managing director) presiding.

In his review of the year, which had been previously circulated, the chairman explained the reasons for their success in the year under review. He said that they had been concerned to widen the range of their products so that they were correspondingly less affected by seasonal influences and by the ups and downs of any particular one of the many industries they served. The policy of ploughing a large part of their income back into research and development was paying good dividends, and they were now experiencing in increasing measure the benefits of the research and development carried out in the last ten or twelve years. Finally, they were now seeing the results from the employment of the additional capital raised in 1956, for many of the developments made possible by the money so provided were only now coming to fruition.

Turning to the different aspects of the business, they were satisfactorily busy during the year in relation to aircraft equipment, and they had been fully occupied at their subsidiary in the nuclear power field, Plessey Nucleonics, Ltd. The radio and television equipment side, together with radio, television and other components, experienced a particularly busy year. With regard to communications equipment, production ran at a high level throughout the year, as was also the case with general electronic production. A material extension of the Swindon factories was effected during the year, and a general measure of progress took place in regard to equipment and products they made there.

Since 30th June last, and particularly since the election, they had been very busy, and the volume of production was running at a higher level than was the case in the corresponding months of 1958.

New Companies

Enfield-Standard Power Cables, Ltd.—Registered 30th December. Capital £1,000,000. To acquire the businesses of the manufacture, marketing and installation of power cables now carried on by (1) Enfield Cables, Ltd., and (2) Standard Telephones & Cables, Ltd., together with all or any of the assets or liabilities of the said businesses or which may be used in connection therewith, etc. Subscribers: J. Grimston and F. C. Wright. The holders of a majority of the "A" and "B" shares each have the right to appoint and remove half the directors. The first directors are not named. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

Morphy-Richards (Cray), Ltd.—Registered 16th December. Capital £100. Manufacturers of and dealers in electrical and other equipment and apparatus of all kinds, etc. Directors: D. W. Morphy and C. F. P. Richards (directors of Astral Equipment, Ltd., etc.). Regd. office: St. Mary Cray, Kent.

British Vacuum Cleaner & Engineering Co., Ltd.—Registered 18th December. Capital £10,000. Regd. office: 3, Great Winchester Street, E.C.2.

Inertia Switch, Ltd.—Registered 14th December. Capital £5,000. Electrical, mechanical and electronic equipment specialists and specialists in acceleration sensitive devices, etc. Directors: H. Kremer and W. W. H. Clarke. Regd. office: Craven House, 121, Kingsway, W.C.2.

Bankruptcies

S. R. L. Sutton, electrical dealer, 127, Sultan Road, Portsmouth, Hants., trading as Sutton & Sons.—Last day for receiving proofs for dividend 9th January. Trustee, Mr. A. H. Horler, 16, Westwood Road, Southampton.

J. Darwen, electrical engineer, formerly carrying on business at Dane Bank House Works, Windmill Lane, Denton, Lancs., previously carrying on business at 23, Reddish Lane, Gorton, Manchester, as an electrical contractor.—First and final dividend of 1s 8½d in the £, payable from today (Friday) at the Official Receiver's office, 20, Byrom Street, Manchester, 3.

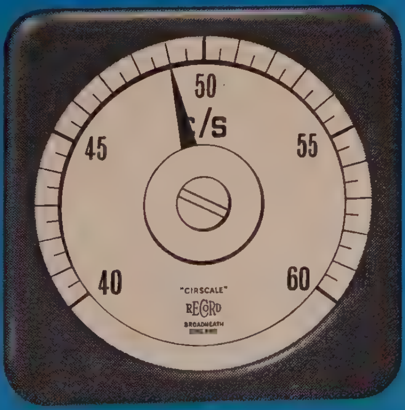
L. D. Richards and **J. R. Richards,** formerly carrying on business in partnership as Streatham Electrics, of 78, Upper Tulse Hill, Streatham, London, S.W.2, electrical contractors.—Order made 20th November suspending discharge for six months until 20th May next.

H. F. Griffiths, electrical engineer, formerly carrying on business at Central Chambers, Walsall Street, Bilston, Staffs.—Order made 27th November suspending discharge for one month.

E. Greenwood, Westgate, Elland, Yorks., electrician.—Receiving order made 22nd December, on a creditor's petition.

Liquidation

Strud Products, Ltd., electrical engineers, Elm Road, Hackbridge Road, Hackbridge.—Winding up voluntarily. Liquidator, Mr. A. Sutherland, 20, Southampton Place, London, W.C.1, appointed 7th December.



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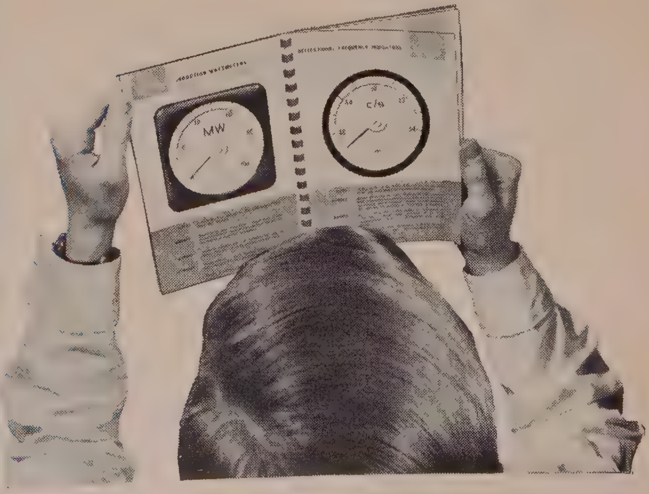

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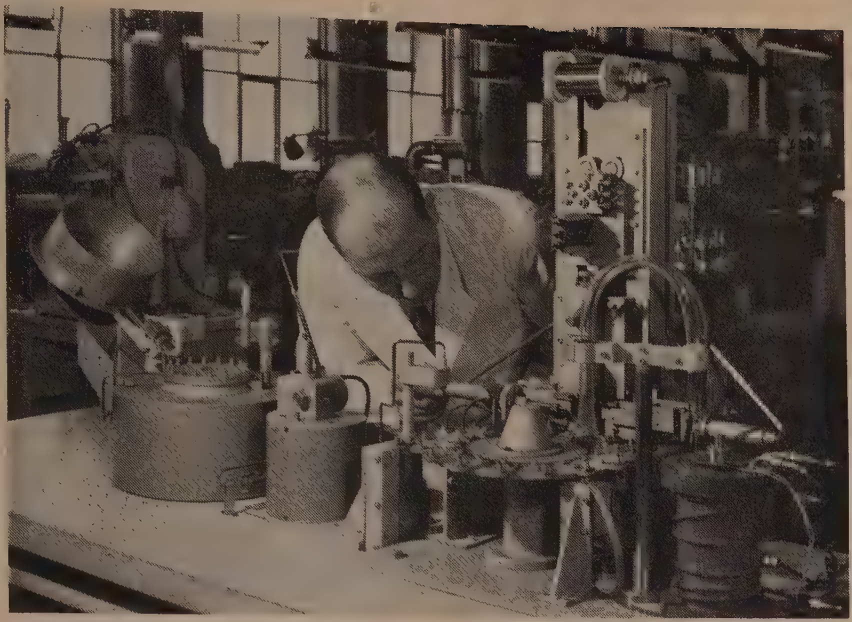
Silicon Diode Production



Automatic diode production plant at the Ferranti Gem Mill factory

An automatic plant for the production of the ZS30 series double-ended diffusion silicon diodes has been put into operation by Ferranti, Ltd., at their Gem Mill factory at Oldham, Lancs. Designed and built by the company's own plant development section, it is estimated that it is capable of producing 43,000 diodes a week. The diodes, rated at 500 mA at 35°C with peak inverse voltages from 50 to 400 V, have a diameter of 3·8 mm and a length of 8 mm. All operations in the final assembly of the header are now carried out by automatic transfer mechanisms. As the stages of copper and gold plating the header assembly and pre-soldering the dice to the header are suited to batch production, no automatic mechanism is used for these processes.

The mechanism used for the assembly of the lead wire to the header is controlled from a camshaft, which enables the overall index figure, nominally eight seconds, to be varied as required. The headers are washed and degreased before being placed in a hopper at one end of the automatic machine. From the hopper, the headers are sorted and presented singly to a magazine. An escape mechanism releases the header down an inclined chute on to an indexing table where it is positioned in a cup by an air jet. Each time the table indexes, a vacuum arm picks a header off the table and transfers it through 180° to a second table where it is accurately located in a nimonic alloy jig. This table then indexes and presents the header to the lead wire and an oxy-coal gas flame is brought into position to make the weld. After welding, the wire is measured to length and cropped by transverse guillotine knives.

The completed header is then indexed to a position where it is transferred through a tube in the form of an inverted U to a small hydrogen furnace where oxide created by welding is removed. After passing through this furnace, the component is collected in a container and taken away to be copper and gold plated. The header, with a solder disc and silicon dice mounted on top and in contact with each other, is then assembled in a jig which is passed through a hydrogen furnace for about 15 minutes. During the cooling cycle the dice adheres to the top of the header.

Post-etching treatment is also carried out automatically by a plant which permits etching liquors, a mixture of hydrofluoric, acetic and nitric acids, to be stored outside the area where the operator is working. A rotary indexing table passes the components through a series of etching, cleaning and drying stations before the final index position where automatic varnishing is carried out. The index position before varnishing is utilised for checking the polarity of the dice by a wire probe. The index figure of this mechanism is variable from five to ten seconds and the period in which the dice is exposed to the atmosphere is limited to 17 seconds.

Before final encapsulation, which is carried out by an automatic machine with an indexing time of 15 seconds, a solder ring is placed on the header plinth and this assembly is located in a small ceramic chuck. The can, complete with glass seal through which the lead wire and compensator pass, is situated directly above the plinth and the whole assembly is placed in a vacuum chamber. The machine indexes through a series of eddy current heating positions until, at a predetermined time, a trip mechanism allows the can to drop on to the plinth, locating the compensator on top of the dice. The table continues to index, during which time the assembly is allowed to cool to form the hermetically sealed encapsulation.

ZENITH Commissioned

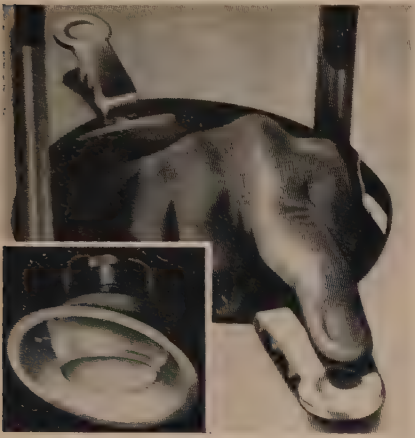
THE ZENITH heated zero energy reactor at the Atomic Energy Establishment, Winfrith, Dorset, started operation for the first time on 19th December. The final stages of commissioning the plant will be carried out during the next few months. ZENITH, which is the first reactor to be built at Winfrith, will initially be used by an international staff to establish design characteristics for a 20 MW high temperature gas-cooled reactor experiment called DRAGON which is to be built at Winfrith.

An Atomic Energy Authority team was responsible for the basic conception of ZENITH, for the approval of contractors' designs and for the inspection and commissioning of the plant. The fuel elements and nucleonic instrumentation were designed and produced by the Authority. The main contractors for the reactor were the General Electric Co., Ltd., Atomic Energy Division, Erith, Kent. A brief description of the reactor was given in an article on the Winfrith Atomic Energy Establishment in our issue of 28th August last.

NEW ELECTRICAL EQUIPMENT

Recessed Lighting Fitting

A new and speedier method of fixing recessed lighting fittings is claimed to have been evolved by C. M. CHURCHOUSE, LTD., Clarendon Works, Clarendon Cross, London, W.11, with the introduction of their "Fixolita" and "Rotolita" units. The fixing method is by two crocodile type clips set in the outer rim of the fitting. By merely pressing the clips with one finger they bend to the ceiling and securely hold the fitting, irrespective of the ceiling thickness. No damage can be done to the fittings, no screws are necessary and there is no searching for fixing laths, etc. The usual ceiling box has been eliminated; only an adjustable lamp housing is needed. The "Fixolita" fixed type fitting is in two sizes, 75/100 W and 150 W, priced at £1 1s 8d and £1 3s 4d respectively, and there is also a 30° angled model (75/100 W) at £1 5s.

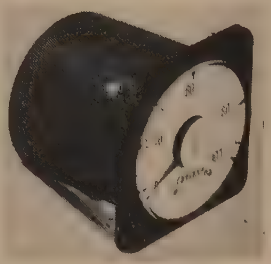


The method of fixing the new Churchouse recessed lighting fittings. Inset: the "Rotolita" swivel type fitting

The "Rotolita" is a swivelled fitting and the two flush models, 75/100 W and 150 W, are priced at £1 1s 8d and £2 1s 8d. A protruding model (150 W) costs £1 13s 4d. The 75 W housing of these fittings adjusts from 2 to 3½in and the 150 W housing from 2½ to 4in. Louvres and skirts are available as additional embellishments and each model has a special adaptor ring should an ordinary lamp be preferred to an internally silvered lamp.

Circular Scale Instruments

The dials of the range of flush mounting, circular scale instruments, designed and styled by CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2, to accord with current North American practice and now available in this country, lie in the same plane as the front of the bezel, ensuring that the scale markings and pointer receive the maximum possible illumination. The indications on the anti-parallax platform scale can be read from the most acute angle. The slightly projecting moulded glass cover is contoured to avoid striations of light across the dial face.



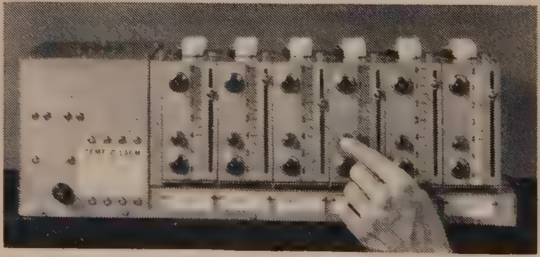
Crompton Parkinson flush mounting meter

The range available includes moving-iron and moving-coil ammeters and voltmeters, single and double element wattmeters, frequency, speed, and power factor indicators, and rotary synchroscopes. All are of nominal 4in size with 3½in dials. The panel clearance hole required is $4\frac{1}{32}$in and fixing is by means of four integral studs.

Temperature Sensing Instrument

Designed to detect and give audible or visible warning of temperature changes, the "Temp-O-Larm" announced by the WALTER KIDDE CO., LTD., Belvue Road, Northolt, Greenford, Middlesex, is intended primarily for use with refrigeration equipment, but may also be used for sensing high or low temperatures in any type of processing equipment or heating and ventilating plant where a thermostat can be situated. The system consists of a small temperature detector placed in each freezing cabinet and connected to an annunciator, a warning being given if the temperature rises above the preset level.

To compensate for the normal temperature increases which result from defrosting cycles or cabinet reloading, there is adjustable automatic control which can be set to delay the alarm for up to six hours and prevent false indication. The unit can be used to give an indication of loss of refrigerant, faulty thermostats and expansion valves. If a complete power failure occurs, an instant warning is given.



Walter Kidde temperature sensing unit connected to six refrigerated cabinets

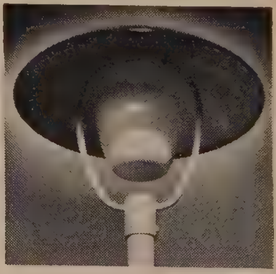
Room Thermostat

A new 20 A room thermostat is announced by the Thermostat Division of R. B. PULLIN & CO., LTD., of Phœnix Works, Great West Road, Brentford, Middlesex. There are several types, all of which have a grey plastic cover and may be fitted with an intermittent neon indicator light. The temperature range is from 30 to 90°F and the temperature differential is 2°F. For heating control two models are available—the A2/W fitted with neon indicator, and the A2/WNL, without the neon indicator.

Pullin A2/W 20 A room thermostat

There are similarly two models for cooling control, the A2/RA and A2/RANL, identical to the heating control models except that the bi-metal strip has been fitted in reverse.

Optional extras for all types include an off/auto switch and a control lock. The price, with neon indicator, is £2 17s 6d; and without, £2 14s 6d.



Troughton & Young F.1001 street lighting fitting

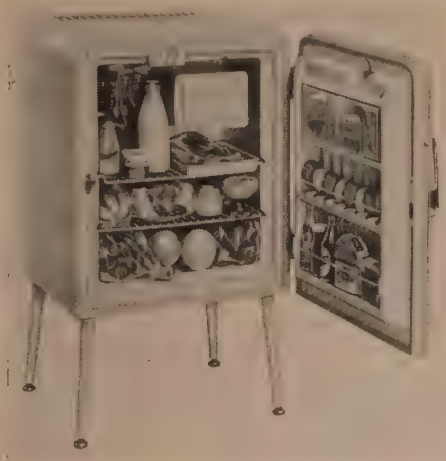
Street Lighting Fitting

Two new fittings for use with class "B" street lighting columns with 3in diameter and 3in long spigot as specified in B.S. 1308 and 1840, have been produced by TROUGHTON & YOUNG (LIGHTING), LTD., 143, Knightsbridge, London, S.W.1. Fitting

F.1001 has a white flashed opal glass with a 5in diameter opening in the base and with a screw threaded top. It is designed to take a 200 W e.s. lamp. The diameter of the top is 28in and it can be finished in any specified colour. The second fitting, F.1002, is similar, but has an enclosed glass and is 22in in diameter. It also takes a 200 W e.s. lamp. The price of either fitting is £17 10s. The poles are not normally included but can be supplied to order.

Table Refrigerator

A new table refrigerator, the "Astral A.200A," has been introduced by Morphy-Richards, Ltd., 50, Conduit Street, London, W.1. This latest model has a capacity of 2 cu ft and replaces the company's previous 1·5 cu ft table model, the "Astral BM/E." Despite its increased capacity, it has almost identical external dimensions as its predecessor, measuring 25½in high by 21¼in wide by 21¼in deep. New features include interior door fittings — large butter rack with "Perspex" sliding doors, egg rack and a third rack for dairy produce. The evaporator unit contains two 12-cube ice trays and can also be used to store up to 5 lb of frozen foods. The two polythene-coated wire shelves are adjustable and a polystyrene drip tray is provided.



Morphy-Richards "Astral A.200A" table refrigerator

The refrigerator is fitted with an absorption unit (loading 95 W) and is available in three voltage ranges, 110/115, 190/220 and 220/250. The cabinet exterior is finished in either white or cream and the interior is in green. The total weight is 75 lb and a set of contemporary styled legs (price £1 9s extra) is available to convert it into a free standing refrigerator. The price, without legs, is £30 19s 6d plus £5 15s 6d purchase tax in the United Kingdom.

Induction Process Heater

The second in the range of induction heaters being introduced by Pye, Ltd., R.F. Heating Division, 28, James Street, Cambridge, is the R.F.2 unit which has a medium impedance output and a continuous rating of 1½ kW at 2 Mc/s. Designed for bench operation, it is similar in appearance to the first model, being housed in an aluminium cubicle and finished in green-grey hammertone enamel, with safety switches on the removable sides. The overall dimensions of the unit are 24⅛in high by 17½in wide by 21¼in deep.

The equipment is self-contained with an automatic resetting process timer, overload relay to protect the valves, and water pressure switch to protect the equipment. Provision is made for remote control and a pulse is available at the end of the heating cycle to initiate a quench or any other operation required. The equipment is designed to be operated from a single-phase supply, 180-250 V, 50 c/s, and has a full-load consumption of 3·1 kW.

Pye r.f. induction heater

Motor Starter

The non-reversing type TFK and reversing type TFW model starters in the TF range produced by Dewhurst & Partner, Ltd., Inverness Works, Hounslow, Middlesex, are now available fitted with a "hand/off/auto" switch. This feature is useful in installations where overriding local control is required for remotely switched electric motors, used in conjunction with automatic switching devices, e.g. humidistats and thermostats. This starter has many applications in pumping, refrigeration, process control, etc.

Dewhurst motor starter

In common with other starters in the TF range, it is fitted with the "Dupar" ET protector giving full safeguards against single-phasing or overloading damage to the motor. The model is suitable for direct-on-line operation of a.c. motors in the range ¼ to 7½ h.p.

Transistor Power Supply

A portable stabilised power unit to supply low-voltage circuits, particularly those using transistors, has been announced by Marconi Instruments, Ltd., St. Albans, Herts. The shunt-stabilised output voltage of the TF 1303 unit is monitored by a built-in large-scale meter and is continuously variable from 2·5 to 24 V, the maximum available output current varying from 1·25 A to 0·2 A. A power-limiting switch restricts the output to a maximum of 12 W, 2 W or 500 mW, preventing accidental transistor burn-out. The output circuit of the unit is isolated from both the supply mains and chassis, enabling either terminal to be connected to earth, or the supply to be arranged to float at a potential not exceeding 100 V with respect to earth.

The d.c. supply is obtained from a mains transformer via a full-wave rectifier comprising two germanium-junction diodes and is fed to the output terminals through a series resistor. A high-power transistor connected across the output forms a shunt regulator under the control of a transistor amplifier, determining the proportion of the rectified voltage developed across the series resistor. The amplifier circuit has four d.c. coupled transistors, and the voltage appearing across the output terminals is applied to the base of the first transistor via a potentiometer which is adjustable from the front panel and forms the output-voltage control. Load regulation of the unit is better than 0·01 V and the ripple content is less than 0·5 mV. It may be operated at ambient temperatures of up to 45°C.

Marconi power supply unit

AUSTRIA'S ELECTRICAL TRADE

DURING 1958 Austria's electrical trade continued its upward trend. Imports rose by 12 per cent to £18·8 million, exports by 23 per cent to £13·6 million. Goods coming from the six Common Market countries accounted for 81 per cent of the imports, the main supplier being Western Germany. Austria's exports were also directed mainly to Europe, the Common Market countries receiving 33 per cent of the total. Trade with the United Kingdom showed an encouraging increase during the year. The important growth of the electronics industry in Austria is clearly reflected in the following tables. With the further extension of Austria's TV network and hydro schemes, there should be a limited market for British manufacturers of equipment not produced or assembled locally. The lowering of Austria's relatively high tariff under the Outer Seven agreement should also help to stimulate trade between the two countries.

Table 1.—Sources of Austria's Electrical Imports in 1958

Country	Value (£000)
United Kingdom	563
West Germany	11,231
Italy	682
Belgium/Luxembourg	65
Denmark	131
France	395
Holland	2,844
Sweden	273
Switzerland	1,401
Czechoslovakia	88
Hungary	85
Canada	45
United States	949

Table 2.—Principal Destinations of Austria's Electrical Exports in 1958

Country	Value (£000)
United Kingdom	262
West Germany	1,522
East Germany	218
Italy	345
Belgium/Luxembourg	255
Hungary	252
Bulgaria	151
France	397
Greece	191
Yugoslavia	737
Holland	1,978
Poland	1,569
Sweden	488
Switzerland	635
Czechoslovakia	501
Russia	722
India	279
Pakistan	305
Egypt	244
South Africa	195
United States	475

Table 3.—Austria's Electrical Imports in 1958

Product	Value (£000)
Motors and generators	1,183
West Germany	749
Italy	435
Holland	235
Generating sets, complete	62
West Germany	47
United States	13
Portable electrical appliances, inc. domestic	4,722
United Kingdom	120
West Germany	3,414
Italy	102
Holland	475
Sweden	151
Switzerland	252
Convertors, rotary	142
West Germany	92
Switzerland	26
Transformers	439
United Kingdom	23
West Germany	195
Holland	32
Switzerland	76
X-ray apparatus and electro-medical appliances, inc. X-ray tubes	285
Radio components	933
West Germany	315
Holland	341
Electro-acoustical equipment	1,287
West Germany	451
Holland	310
United States	435
Telegraph and telephone apparatus	296
Measuring, indicating and recording equipment	395
West Germany	302
Filament lamps	325
Electronic tubes	762
Heating appliances	1,046
West Germany	710
Italy	211
Switzerland	55
Cables, lead covered	20
Cables and wires, others	220
West Germany	122
Steam turbines	640
Water turbines	175
West Germany	112
Italy	63

Table 4.—Austria's Electrical Exports in 1958

Product	Value (£000)
Motors and generators	1,516
West Germany	218
Italy	74
France	61
Holland	28
Poland	102
Sweden	122
Switzerland	131
Russia	27
India	92
Finland	62
United States	112
Pakistan	68
Australia	31
Generating sets, complete	195
Pakistan	64
Egypt	33
Portable electrical appliances, inc. domestic	264
West Germany	44
Italy	22
Holland	45
Switzerland	69
Convertors, rotary	349
West Germany	67
France	139
Yugoslavia	93
Poland	362
Sweden	72
Hungary	51
India	60
Pakistan	61
United States	199
Australia	62
X-ray and electro-medical equipment, inc. X-ray tubes	135
Radio apparatus	428
Radio components	200
United Kingdom	18
West Germany	21
Holland	12
Poland	62
Electro-acoustical equipment	2,253
United Kingdom	112
West Germany	320
Holland	1,453
Telegraph and telephone apparatus	282
Measuring, indicating and recording instruments	580
West Germany	43
Yugoslavia	59
Poland	79
Sweden	39
India	51
Filament lamps	232
Electronic tubes	402
Heating appliances	725
West Germany	103
Yugoslavia	82
Czechoslovakia	357
Cables, lead covered	643
Bulgaria	69
Poland	198
Russia	143
Cables and wires, others	632
Russia	95
Yugoslavia	135
Poland	193
Accumulators	192
Steam turbines	52
Water turbines	65
West Germany	16
Lebanon	19
Russia	20

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 23rd January:—

General Ermetic. No. 785,112. Class 7. Refrigerator compressors (machines), washing machines for domestic use, ironing machines, and parts.—Compagnie Française Thomson-Houston, Paris, France. Address for service, c/o Baron & Warren, 16, Kensington Square, London, W.8.

Rayseal. No. B789,294. Class 7. High frequency electronic machines for bonding plastics, paper, cardboard or paperboard by heat treatment.—Raybond Electronics, Inc., Newton Highlands, Mass., U.S.A. Address for service, c/o Edward Evans & Co., 53-64, Chancery Lane, London, W.C.2.

Citenco (design). No. 792,533. **Citenco.** No. 792,534. Class 7. Electric motors (not for vehicles).—City Engineering Co. (Boreham Wood), Ltd., Manor Way, Boreham Wood.

G. Marconi (design). Nos. 773,492 and 773,493. **Marconi.** No. 773,494. Class 9. Television receiving sets, radiogramophones and instruments for reproducing sound from records, and parts, for sale only through retail shops. **Marconi.** No. 773,495. **G. Marconi** (design). No. 773,496. Class 9. Thermionic valves, dry rectifiers and transistors, all for use in radio receiving sets and in television sets.—Marconiphone Co., Ltd., Blyth Road, Hayes, Middx.

No. 782,778 (design). Class 9. Electrical apparatus and parts; and electric semiconductor devices.—Intermetall Gesellschaft für Metallurgie u. Elektronik m.b.H., Düsseldorf, Germany. Address for service, c/o Elkington & Fife, Bank Chambers, 329, High Holborn, London, W.C.1.

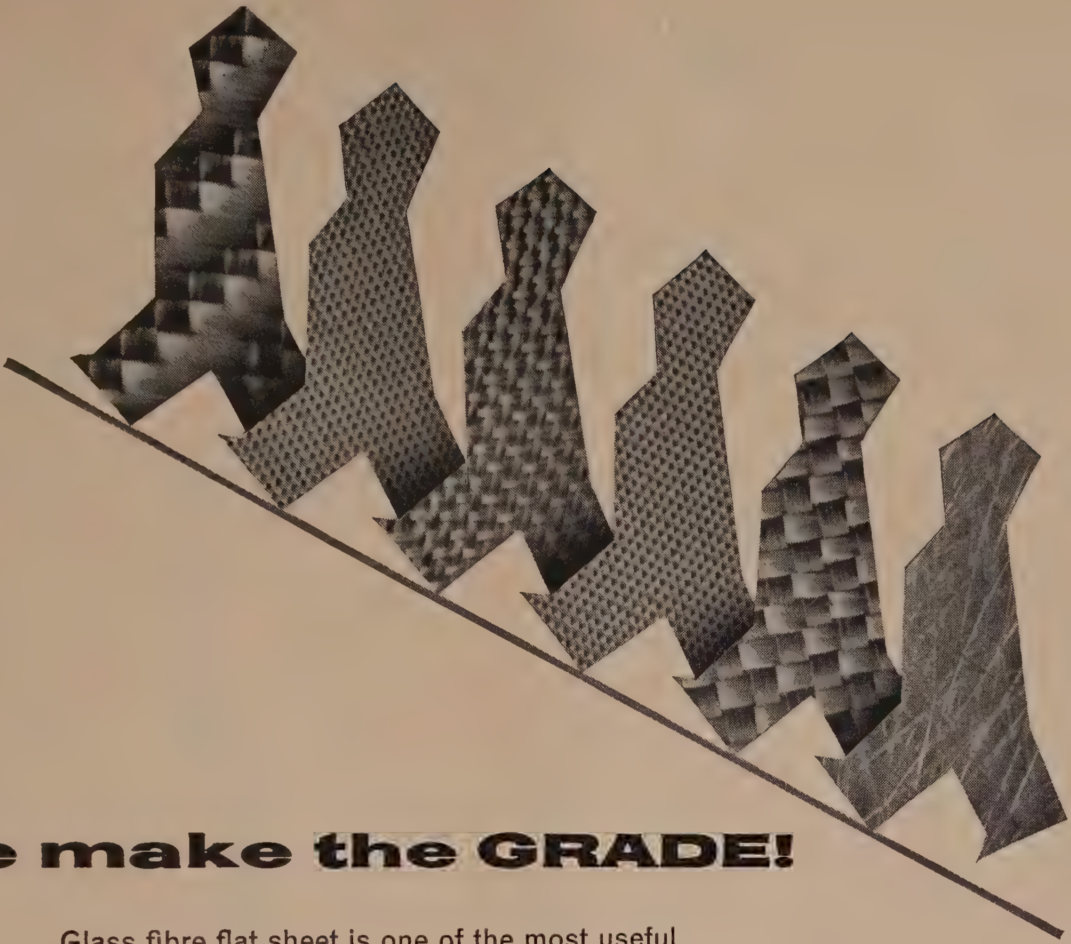
Lumenar. No. B792,329. Class 9. Cathode ray tubes and parts.—Mullard, Ltd., Mullard House, Torrington Place, London, W.C.1.

Plexitel. No. 793,064. Class 9. Radio transmitting, receiving, relaying and repeating apparatus.—Westrex Corporation, New York, U.S.A. Address for service, c/o F. C. Tomlins, 14, Alderton Hill, Loughton, Essex.

Electrovac. No. 794,267. Class 9. Glass to metal terminal seals for electronic components.—H. Joseph, Llanvair Lodge, Llanvair Drive, Ascot, Berks.

Torex. No. 794,270. Class 9. Electric discharge tubes (not for lighting), and semiconducting devices.—Tottenham Radio Valve Co., Ltd., West Road, Tottenham, N.17.

Global. No. B780,654. Class 11. Electric ventilating fans.—Veritys, Ltd., Hazelwell Works, Fordhouse Lane, Stirchley, Birmingham, 30.



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GRADE 21/BE — Phenolic Resin/Fine Weave Cloth – E Glass. A fine weave glass cloth phenolic resin laminate having good electrical properties suitable for high temperature work and chemically resistant.

GRADE 23/CE — Polyester Resin/9 oz. roving cloth—E Glass. A general purpose coarse weave glass cloth polyester laminate, generally similar to Grade 23/BE but for use in greater thicknesses.

GRADE 24/CE — Epoxide Resin/9 oz. roving cloth — E Glass. A coarse weave glass cloth epoxide resin laminate, generally similar to Grade 24/BE but for use in greater thicknesses.

GRADE 22/BD/1—Melamine Resin/Fine Weave Cloth–E Glass. A fine weave glass cloth melamine resin laminate which is non-inflammable, has good electrical properties and conforms to Def. 5000, spec. M1.

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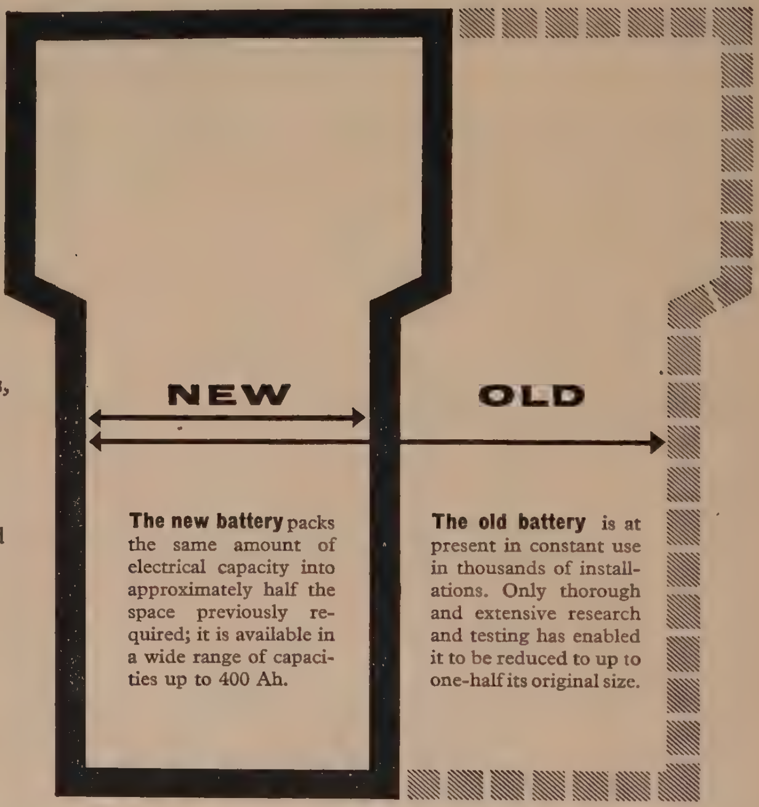
BATTERY SPACE REDUCED BY HALF

WITH THE NEW TUDOR HIGH PERFORMANCE STATIONARY CELL

Savings of up to 50% in the space required for a stationary battery are made with the introduction of a new Tudor cell. A high performance sealed cell with Planté positive plates and pasted grid negative plates, separated by ribbed diaphragms of microporous Porvic, it is specially designed for trickle-charge operation.
It is therefore the ideal cell for all stand-by applications, including emergency lighting in hospitals, cinemas, theatres and public buildings of all kinds, and auxiliary duties in both nuclear and conventional power stations.
The design of the cell results in a lower internal resistance and therefore provides a very much improved high rate performance, making it eminently suitable for switch-operating duties where high rates of discharge are involved.
With the great reduction of space required, and the renowned reliability and long life of its predecessors, this new Tudor high performance cell marks a great step forward in stationary battery design.

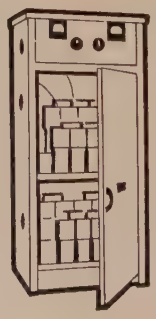


The new battery packs the same amount of electrical capacity into approximately half the space previously required; it is available in a wide range of capacities up to 400 Ah.

The old battery is at present in constant use in thousands of installations. Only thorough and extensive research and testing has enabled it to be reduced to up to one-half its original size.

THE IMPROVED SAFETYLYTE EMERGENCY LIGHTING EQUIPMENT

Tudor Safetylyte equipments are now being fitted with the new stationary cell. Charge and control cubicles are of improved design – the larger equipments being of folded sheet steel, and the smaller specially constructed for wall-mounting, employing automatic mercury relay in place of a contactor.



THE NEW SWITCH-TRIPPING EQUIPMENT

Tudor switch-tripping units will in future be fitted with the new cell. The cubicles have also been redesigned, and are available in folded sheet steel or wooden cabinet construction. The charger can now be used for both trickle and quick charging.

T 173A

Tudor TUDOR BATTERIES

THE D.P. BATTERY CO. LTD, MAKERS OF KATHANODE AND TUDOR BATTERIES, BAKEWELL, DERBYSHIRE. TEL BAKEWELL 581-5

New Books

The Elements of Determinants, Matrices and Tensors for Engineers. By S. Austen Stigant. Pp. 433; figs. Macdonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 60s.

This book, which has been written for students of electrical engineering, is in three parts, dealing with determinants, matrices and tensors. The theory in all three parts is correlated with the theory for the solution of sets of simultaneous equations, and the student is reminded of the importance of such equations in the analysis of the performance of polyphase networks and machines.

The elementary relationships existing between determinants, matrices and tensors are discussed at great length and simple applications are made to electrical problems. A student approaching the subject for the first time may find these detailed discussions the most valuable feature of the book, but a mathematician would probably find them tedious.

The electrical examples given deal only with simple forms of stationary networks, but they are discussed in terms of tensors in Part III. It would have made things much easier for the student if these problems had been dealt with in terms of simple matrices in Part II. Tensor equations become necessary only when it is required to calculate the performance of non-stationary networks (as are met in rotating machines), but non-stationary networks are not discussed in this book.

The author does not make it clear to the student that tensor equations are of use principally in proving general theorems. In practical engineering applications there is usually some asymmetry about the co-ordinates that makes it necessary to abandon the tensor form at some stage in the work. The author stresses the point that tensors are sets of quantities obeying certain transformation laws. Their importance lies in the fact that if a tensor equation is found to hold for one system of co-ordinates, it continues to hold when any transformation of co-ordinates is made. New tensors are recognised either by investigating their transformation laws directly or by the property that the sum, difference, product, or quotient of tensors is a tensor. Thus, the tensor calculus may be regarded as a generalisation of the method of dimensions in physics.

This book can be recommended to all those who are interested in the application of mathematics to electrical engineering. It is very well produced, the type is easy to read and the diagrams in the text are clearly constructed.—H.J.J.

Process Integration and Instrumentation. Pp. 204; figs. 141. Published by the British Electrical Development Association, 2, Savoy Hill, London, W.C.2. Price 8s 6d.

The latest addition to the Electrical Development Association's series of "Electricity and Productivity" books is "Process Integration and Instrumentation." This book has been written to meet the requirements of the industrial manager and production executive of the medium and small concern. It indicates that the steps which lead from detection and measurement to indication, recording and eventually to automatic control are intricate and impinge on a wide range of specialised skills. Chemistry, physics, electrical, mechanical, electronic and nuclear engineering are involved, all of which have their peculiar and rapidly extending vocabularies. The book outlines in simple form the means by which the variables occurring in manufacturing can be sensed, measured and controlled with the ultimate object of achieving a more completely and perfectly integrated process. An extremely wide field is covered in a very readable style without recourse to mathematical formulæ or references to abstruse points of design.

The volume includes 141 specially selected illustrations and the 13 chapters cover such subjects as modern manufacturing, automatic control, sensing, instruments and instrumentation, electrical and electronic links, actuators and servo-motors, industrial applications, computers, control of machine tools, movement of materials, quality control, design and servicing, and progress towards automation. This book is the eighth in the series, the previous titles being "Higher Industrial Production with Electricity," "Lighting in Industry," "Electric Motors and Controls," "Materials Handling in Industry," "Electric Resistance Heating," "Induction and Dielectric Heating" and "Industrial Electric Trucks."—T.R.W.

Electro-Technology for National Certificate Courses. Volume III. By H. Buckingham and E. M. Price. Pp. 361; figs. 295. English Universities Press, Ltd., 102, Newgate Street, London, E.C.1. Price 16s.

This volume is intended to cover the material required in the third year of the O.N.C. course, together with some matters usually covered in the first year of the higher course. The arrangement of the chapters follows that of the course, and the topics dealt with include d.c. machines, electric and magnetic fields, elementary circuit theory by the symbolic method, polyphase a.c., transformers, rotating fields and more advanced circuit theory, conversion of a.c. to d.c., electronics, and economic considerations, concluding with complex waveforms.

The authors are experienced teachers and the book is extremely clear and correct in its emphasis on the more fundamental parts of the subject rather than on purely technological questions. It is suggested, however, that the procedure for introducing the j method, although well used, is not, in fact, the most satisfactory one. Also, three-phase circuit problems are generally more easily solved by nodal analysis than by mesh analysis and it is a pity that the authors do not seem to mention the nodal analysis technique, particularly since the subject of circuit analysis is of basic importance to every electrical engineer.

This book, at its designed level, is a great improvement on some well-known predecessors and is thoroughly welcome.—A.H.B.

Calculation of Axial Forces in High-Power Electric Transformers. By I. S. Gheorghiu, A. Fransua and A. Moraru. Pp. 158; figs. Institutul de Energetica, Sectia Documentare, Bucharest 1, Roumania.

Details are given of the results obtained from research work carried out by the Institute of Power-Engineering of the Roumanian Academy in connection with the determination of axial forces occurring in high-power electrical transformers during a short circuit.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1946

12574. Fermi, E.—Nuclear reactor. 25th April, 1946. (826929.)

1947

9517. Ginns, D. W., and Gott, H. H.—Nuclear reactors. 8th April, 1948. (826930.)

1949

20889. United Kingdom Atomic Energy Authority.—Heat transfer systems. 4th August, 1950. (826931.)

1954

30664. Robinson, W. L., and Perkins, G. H.—Signalling on telephone systems. 25th January, 1956. (826933.)

1955

11676. English Electric Co., Ltd.—Systems for controlling temperature by electrical heating. 17th April, 1956. (826913.)

15738. Brown, J., and Jackson, W.—Microwave radio and radar apparatus. 25th May, 1956. (826939.)

32930. Philco Corporation.—Semiconductor signal translating devices. 17th November, 1955. (826916.)

1956

4912. Yardney International Corporation.—Manufacture of electric cells or batteries. 16th February, 1956. (826855.)

5014. General Electric Co., Ltd.—Electric discharge lamps. 18th February, 1957. (826954.)

5948. Bosch G.m.b.H., R.—Self-sealing electric condensers. 25th February, 1956. (826955.)

6033. Minnesota Mining & Manufacturing Co.—Shock resistant mounting means for frangible electrical conductors. 27th February, 1956. (826841.)

9967. General Electric Co.—Apparatus for filling devices such as electronic tubes with a predetermined quantity of gas. 29th March, 1956. (826965.)

13864. Philips Electrical Industries, Ltd.—Uncoated electrodes for use in electric arc welding. 4th May, 1956. (826860.)

18948. Simmonds Aerocessories, Ltd.—Circuits for obtaining indications dependent on capacitance. 14th June, 1957. (826969.)

21031. King, H. W. M.—Electrical busbar assemblies. 28th June, 1957. (826971.)

21413. Ericsson Telephones, Ltd.—Means for the termination of electrical conductors. 11th July, 1956. (826973.)

22632. Postmaster General.—Apparatus for laying submarine cables. 30th September, 1957. (826974.)

22644. Egen Electric, Ltd., and Bowman, A.—Aerial coupling devices. 21st October, 1957. (826975.)

25421. Gray, V. C.—Electrical sound reproducing devices. 6th August, 1957. (826980.)

28215. General Electric Co., Ltd.—Refractor members for lighting fittings for street lighting and like purposes. 13th September, 1957. (826919.)

28790. Electronic Associates, Inc.—Vacuum tube amplifiers. 20th September, 1956. (826985.)

29715. Sunbeam Corporation.—Electric appliance plug and receptacle. 28th September, 1956. (826986.)

32478. Sylvania Electric Products, Inc.—Electroluminescent image display device. 24th October, 1956. (826991.)

32726. General Electric Co.—Earthing devices. 26th October, 1956. (826868.)

33248. General Electric Co.—Magnetic networks. 31st October, 1956. (826992.)

33900. Isted, A. E.—Methods of applying antiseptic appliances for telephones and speaking apparatus. 6th February, 1958. (826993.)

34490. Chloride Batteries, Ltd.—Tubular type plates for lead-acid electric accumulators. 1st October, 1957. (826996.)

38709. British Telecommunications Research, Ltd.—Telephone instruments. 17th December, 1957. (826869.)

1957

427. Marconi's Wireless Telegraph Co., Ltd.—Aerial systems. 16th September, 1957. (827083.)

869. Brown, Boveri & Cie. A.G.—Stator for electrical machines. 9th January, 1957. (827223.)

1300. United States Atomic Energy Commission.—Nuclear reactors. 14th January, 1957. (827085.)

1483. Westinghouse Electric Corporation.—Incandescent electric lamps. 15th January, 1957. (827013.)

2193. Sylvania Electric Products, Inc.—Television apparatus. 21st January, 1957. (827225.)

3179. General Electric Co., Ltd.—Electric furnaces. 29th January, 1958. (827509.)

3778. Metropolitan-Vickers Electrical Co., Ltd.—Railway signalling systems. 4th February, 1958. (827008.)

3954/5. General Electric Co., Ltd.—Electric trunking. 5th February, 1958. (827155/6.)

4817. Siemens & Halske A.G.—Electronic tubes having a glass-to-metal seal. 12th February, 1957. (827399.)

6071. Babcock & Wilcox Co.—Sealed pressure vessel. 22nd February, 1957. (827316.)

7773. Deutsche Gold- und Silberscheideanstalt vorm. Roessler.—Concentric lead-in arrangement for induction furnaces. 8th March, 1957. (827009.)

8769. Electric Storage Battery Co.—Electric storage batteries. 18th March, 1957. (827236.)

11267. Phoenix-Rheinrohr Aktiengesellschaft Vereinigte Hütten- und Röhrenwerke, and A.C.E.C. Ateliers de Constructions Electriques de Charleroi S.A.—Apparatus for the electro-inductive heating of the longitudinal edges of a metal strip. 5th April, 1957. (827240.)

14020. Marconi's Wireless Telegraph Co., Ltd.—Cathode-ray tubes. 11th February, 1958. (827482.)

14064. Metropolitan-Vickers Electrical Co., Ltd.—Waveguides. 9th May, 1958. (827095.)

15263. Marconi's Wireless Telegraph Co., Ltd.—Directional aerial systems. 11th February, 1958. (827328.)

15641. Leeds & Northrup Co.—Control systems for electrical generating units. 16th May, 1957. (827242.)

16327. English Electric Co., Ltd.—High temperature electric insulating materials. 19th May, 1958. (827243.)

16912. British Thomson-Houston Co., Ltd.—Electrical instrument and the like transformers. 16th April, 1958. (827097.)

17338. Westinghouse Electric Corporation.—Compressed gas electric circuit interruptors. 31st May, 1957. (827408.)

17357. Marconi's Wireless Telegraph Co., Ltd.—Variable impedance transmission lines. 31st May, 1957. (827021.)

17685. Pirelli S.p.A.—Manufacture of oil-filled electric cables. 4th June, 1957. (827410.)

17804. British Insulated Callender's Cables, Ltd.—Methods of attaching studs to metal bars and other metal articles. 3rd June, 1958. (827245.)

17843. Westinghouse Electric Corporation.—Electric discharge devices. 5th June, 1957. (827487.)

18057. Collins Radio Co.—U.h.f. impedance matching means. 6th June, 1957. (827024.)

19634. General Electric Co., Ltd.—Electric lighting fittings for street lighting and like purposes. 25th June, 1957. (Cognate application 19635/57, 11th September, 1956.) (Divided out of 819993.) (827026.)

20721. VDO Tachometer Werke A, Schindling G.m.b.H.—Electrical plug and socket connector plates. 1st July, 1957. (827249.)

21931. Chicago Telephone Supply Corporation.—Electric switch with terminal assembly adapted for connection to printed circuits. 10th July, 1957. (826877.)

1958

7092. Amp, Inc.—Tools for crimping electrical connectors. 5th March, 1958. (826897.)

5651. Belling & Lee, Ltd.—Electrical connectors. 21st February, 1958. (826817.)

9711. Philips Electrical Industries, Ltd.—Circuit arrangements for television receivers. 26th March, 1958. (826821.)

9874. Philips Electrical Industries, Ltd.—Magnet systems for magnetrons. 27th March, 1958. (826822.)

11944. Philips Electrical Industries, Ltd.—Semiconductor electrode devices. 15th April, 1958. (826823.)

14004. Belling & Lee, Ltd.—Electrical sockets. 2nd May, 1958. (826825.)

19007. Standard Telephones & Cables, Ltd. (Lorenz A.G., C.).—Circuit arrangement for checking the faultless transmission of teleprinter characters. 13th June, 1958. (826828.)

1959

6553. Minnesota Mining & Manufacturing Co.—Sealing of enclosures for electrical devices. 27th February, 1956. (826842.)
6554. Shock-resistant mounting means for frangible electrical conductors. 27th February, 1956. (Divided out of 826841.) (826843.)

Catalogues and Lists

CONDUITS.—Catalogue covering pitch fibre cable conduits.—**Union Fibre Pipes (Great Britain), Ltd.,** Tolpits, Watford, Herts.

GEAR UNITS.—24-page catalogue (758) listing combined spur and worm double-reduction gear units.—**Crofts (Engineers), Ltd.,** Bradford, 3.

INSTRUMENTS.—Four leaflets dealing with a diode function generator, an analogue tutor, a digital data recorder, and an X-ray spectrometer.—**Solartron Electronic Group, Ltd.,** Thames Ditton, Surrey.

12-page catalogue in German (F.25GH) on instruments produced by the company.—**Negretti & Zambra, Ltd.,** 122, Regent Street, London, W.1.

Three leaflets dealing with torque motors, a portable automatic cable tester, and a transistor curve tracer which is able to test up to 80 semiconductors simultaneously.—**De Havilland Propellers, Ltd.,** Hatfield, Herts.

SPRING CLIPS.—Brochure illustrating a range of spring clips, including patterns specially designed for securing capacitors in fluorescent lighting units.—**Lewis Spring Co., Ltd.,** Resilient Works, Redditch.

TELETAPE MACHINES.—Leaflet describing a teletape transceiver of the type installed at the B.O.A.C. Control Centre, London Airport.—**Creed & Co., Ltd.,** Telegraph House, Croydon, Surrey.

WELDING EQUIPMENT.—Leaflet (26) describing capacitor discharge welding apparatus.—**Spembly, Ltd.,** New Road Avenue, Chatham, Kent.

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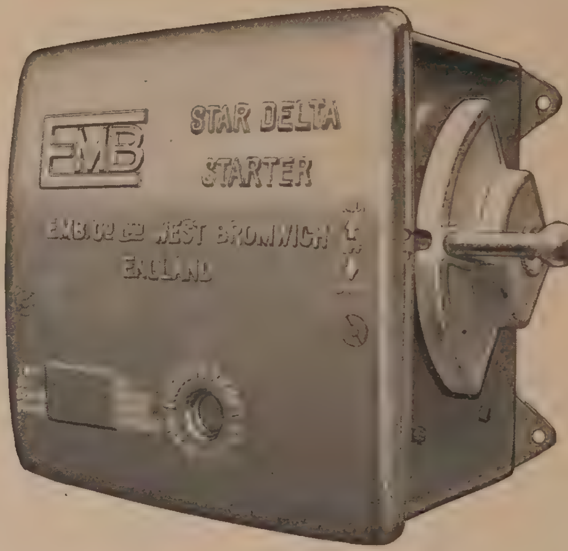

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the “Electrical Review” clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

MONDAY, 11th JANUARY

Birmingham.—College of Technology, Gosta Green, 6 p.m. I.E.E. South Midland Supply and Utilisation Group. “Electrical Supplies to Power Station Auxiliaries,” by D. A. Dewison.

Bournemouth.—Grand Hotel, Firvale Road, 8 p.m. A.S.E.E. Bournemouth and District Branch. “New Methods and Techniques in the Electrical Industry,” by Dr. H. G. Taylor.

Bristol.—The University, 6 p.m. I.E.E. Western Centre. “The Application of L.P. Resins to some H.V. Switchgear Designs,” by T. R. Manley, K. Rothwell and W. Gray.

Liverpool.—University Club, 7 p.m. British Institution of Radio Engineers, Merseyside Section. “High Frequency Propagation—its Present and Future use for Communication Purposes,” by A. F. Wilkins.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. “A Quadrature Network for Generating Vestigial-Sideband Signals,” by G. G. Gouriet and G. F. Newell; and “Rectifier Modulators with Frequency-Selective Terminations, with particular reference to the Effect of Even-Order Modulation Products,” by D. P. Howson and Prof. D. G. Tucker.

White Hall Hotel, Bloomsbury Square, W.C.1, 7.15 p.m. A.S.E.E. Central London Branch. “Present-day Computers,” by W. F. M. Payne.

Caxton Hall, S.W.1, 7 p.m. E.P.E.A. London Technical Group. “Condensing and Feed Heating Plant,” by J. Gibbins.

Newcastle-on-Tyne.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Centre. “Research on the Performance of High-Voltage Insulators in Polluted Atmospheres,” by Dr. J. S. Forrest, P. J. Lambeth and D. F. Oakeshott.

Sheffield.—Grand Hotel, 6.30 p.m. I.E.S. Sheffield Centre. Presidential address, by H. G. Campbell.

Livesey Clegg House, 44, Union Street, 7.30 p.m. Junior Institution of Engineers, Sheffield Section. Film on the Jodrell Bank Radio Telescope, “The Inquisitive Giant.”

Wembley.—Century Hotel, 8.15 p.m. A.S.E.E. North West London Branch. “Recent Developments in Telecommunications,” by H. E. J. Butler.

TUESDAY, 12th JANUARY

Belfast.—David Keir Building, Queen's University, Stranmillis Road, 6.30 p.m. I.E.E. Northern Ireland Centre. “Generator/Motor Problems in Pumped-Storage Installations,” by Dr. J. H. Walker.

Cardiff.—At the South Wales Institute of Engineers, Park Place, 7.30 p.m. A.S.E.E. South Wales Branch. Films evening.

Chester.—Westminster Hotel, City Road, 7.45 p.m. A.S.E.E. Chester and District Branch. “Flameproof Electrical Equipment,” by W. T. Partington.

Glasgow.—Kenilworth Hotel, Queen Street, 8 p.m. I.E.S. Glasgow Centre. “Modern Lighting Techniques,” by M. J. Powley. (Joint meeting with A.S.E.E.)

London.—Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club. Luncheon. Guest speaker, Lord Verulam.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Utilisation Group. “The Characteristics and Protection of Semiconductor Rectifiers,” by D. B. Corbyn and N. L. Potter.

Engineers' Club, Albert Square, 7.15 p.m. Institution of Plant Engineers. Paper by Dr. F. C. Williams.

Portsmouth.—Offices of the Ministry of Labour and National Service, Lake Road, 7.30 p.m. A.S.E.E. Portsmouth and District Branch. “Industrial Lighting Design.”

Rugby.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Graduate and Student Section. “High Frequency Alternators,” by E. Beedham.

Workington.—College for Further Education, 7 p.m. I.E.E. North Eastern Centre. “Submersible Pumping Plant,” by H. H. Anderson and W. G. Crawford.

York.—Georgian House, Blossom Street, 7.30 p.m. A.S.E.E. York Branch. Films.

WEDNESDAY, 13th JANUARY

Birmingham.—James Watt Memorial Institute, 6.30 p.m. I.E.E. South Midland Graduate and Student Section. Students' lecture, “Development in Lighting,” by Dr. F. A. Benson.

Engineering Centre, Stephenson Place, 7.30 p.m. A.S.E.E. Birmingham Branch. “Transformers,” by F. Yates.

Bristol.—At the Royal Society for the Prevention of Accidents, 1a, Queens Square Avenue, 7.15 p.m. Institution of Plant Engineers, Western Branch. “Safety in Factories.”

College of Technology, Ashley Down, 7 p.m. I.E.E. Bristol Graduate and Student Section. “A New Method of Analysis for Single-phase Motors,” by J. Rye.

Cardiff.—Welsh College of Advanced Technology, 6.30 p.m. British Institution of Radio Engineers, South Wales Section. “Television Broadcasting Methods,” by H. J. M. Hockley and N. Hughes.

Chesterfield.—Technical College, 7 p.m. I.E.E. Sheffield Sub-Centre, Graduate and Student Section. “Programming,” by P. N. Baker.

Dundee.—Taypark Hotel, West Ferry, 7.30 p.m. Institution of Plant Engineers. “Surveying Electrical Equipment to Comply with the Factories Act,” by J. Townsley.

Edinburgh.—Y.M.C.A. Social Room, 14, South St. Andrew Street, 6.15 p.m. I.E.S. Edinburgh Centre. “Hospital Lighting,” by G. R. N. Chalmers.

Royal Society Hall, 24, George Street, 7.15 p.m. Ministry of Works. “Artificial Lighting for Modern Buildings,” by J. B. Harris.

Eltham.—Eltham Green School, Queenscroft Road, S.E.9, 7.45 p.m. A.S.E.E. South East London Branch. “The Engineer in Chemical Manufacturing,” by A. F. Hickford.

Hull.—Royal Station Hotel, 2.30 p.m. Combustion Engineering Association, Northern Region. “The Working of the Clean Air Act.”

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. “Gaseous Discharge Phenomena in High-Voltage D.C. Cable Dielectrics,” by E. C. Rogers and D. J. Skipper.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. “A Proposed Space-charge-limited Dielectric Triode,” by Dr. G. T. Wright.

Hope House, 45, Great Peter Street, Westminster, S.W.1, 7 p.m. Women's Engineering Society. “Health Physics and Nuclear Power,” by B. C. Godbold.

Newport.—King's Head Hotel, 6.30 p.m. Newport and District Electric Club. “Safety in the use of Electricity—Fire and Explosion Risk,” by S. J. Emerson.

Northampton.—College of Technology, 7.15 p.m. Northampton and District Electrical Association. “Jodrell Bank Radio Telescope,” by C. N. Kington.

Preston.—North Western Electricity Board Demonstration Theatre, Friargate, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. “Electrification of the U.K.A.E.A. Industrial Group Factories,” by J. W. Binns and W. J. Outram.

Wakefield.—Strafford Arms Hotel, 7 p.m. I.E.E. North Midland Graduate and Student Section. “The Use of Electricity in Hazardous Atmospheres,” by P. A. D. Sheen.

Wolverhampton. — Wolverhampton and Staffordshire College of Technology, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midlands Section. “Electronics in Medicine,” by P. Styles.

THURSDAY, 14th JANUARY

Bradford.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford and District Branch. “Photocells and Their Uses in Industry.”

Dundee.—Electrical Engineering Department, Queen's College, 7 p.m. I.E.E. North Scotland Sub-Centre. “The Deltic Locomotive,” by C. M. Cock.

Glasgow. — Scottish Building Centre, 425/427, Sauchiehall Street, 7.15 p.m. Institution of Plant Engineers, Glasgow Branch. “Selection of Heating Systems for Factories and Offices,” by T. Turner.

Liverpool. — M.A.N.W.E.B. Industrial Development Centre, Paradise Street, 7.15 p.m. Society of Instrument Technology, Liverpool Section. “The Genealogy of Remote Control,” by A. L. Hancock.

The University, 7 p.m. Institute of Physics, Liverpool and North Wales Group. “Electronic Applications of Super-Conductivity,” by Dr. E. Mendoza.

London.—St. Ermin's Hotel, Westminster, 10.30 a.m. Combustion Engineering Association, Southern Region. Discussion on “Factors Affecting the Choice of New Boiler Plant,” opened by W. Short.

Criterion, Piccadilly. Plastics Institute, London and District Section. Annual dinner-dance.

Manchester. — Demonstration Theatre, Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. “Lighting as an Aid to Police Photography,” by Det. Sgt. H. Martin.

Swansea.—South Wales Electricity Board's Showrooms, The Kingsway, 6 p.m. Institution of Electrical Engineers, West Wales (Swansea) Sub-Centre. “Silicone Electrical Insulation,” by J. H. Davis.

Wimbledon. — Prince of Wales Hotel. A.S.E.E. South West London Branch. Branch Lecturette Competition.

FRIDAY, 15th JANUARY

Aberdeen.—Robert Gordon's Technical College, 7.30 p.m. I.E.E. North Scotland Sub-Centre. “The Deltic Locomotive,” by C. M. Cock.

Birmingham.—Queen's Hotel. I.E.S. Birmingham Centre. Annual dinner.

James Watt Memorial Institute, Great Charles Street, Birmingham, 3, 6.30 p.m. Plastics Institute, Midlands Section. “Plastics in Electronics,” by Dr. H. A. K. Eden.

Bristol.—The University, 7 p.m. Institute of Physics, South Western Group. “Science on Television,” by A. J. Garratt.

Leeds.—Queen's Hotel. Institution of Plant Engineers, West and East Yorkshire Branch. Annual dinner-dance.

London.—Café Royal, 7 for 7.30 p.m. I.E.E. Utilisation Section. Dinner-dance.

Newcastle-upon-Tyne. — King's College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. “The Design of Power Transformers by Digital Computer,” by A. C. Hall.

Fire Protection Conference

Government support is being given to the first National Fire Protection Conference, sponsored by the Fire Protection Association, which will be held in London on 25th and 26th February next. The Government will be represented by Mr. R. A. Butler, the Home Secretary, who is to address the conference, and Mr. E. Heath, the Minister of Labour, who will be the principal guest at the conference dinner on 25th February.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Electricity Trust of South Australia, Adelaide. 16th February. Plant and equipment for Nangwarry power station, including 3·2 MW turbo-alternator, 11 kV switchgear, control boards, meters and relays, 11 kV and 400 V power cables, contactors, fuse boards, lighting and power services and control wiring. (E.S.B. 29813/59. Ten/44051.)*

Postmaster General's Department, Melbourne. 16th February. Equipment for 12-channel open wire carrier systems. (E.S.B. 29088/59. Ten/43984.)* 25th February. Waveguide components for research laboratories. (E.S.B. 29089/59. Ten/43985.)*

Barking.—Corporation. 13th January. Class "A" street lighting equipment. (See this issue.)

Calne.—Corporation. Insertion of immersion heaters in existing hot water cylinders, together with all wiring, in 250 domestic dwellings. Borough surveyor, Patford House.

Carlisle.—Corporation. 20th January. Erection of 120 group "B" street lamps with either mercury fluorescent or sodium lighting. City engineer, 18, Fisher Street.

Churchdown. — Parish Council. 29th January. Trunk road lighting equipment. (See this issue.)

Costa Rica.—La Proveeduria, Instituto Costaricense de Electricidad, San Jose. 20th January. Six electric pumps. (E.S.B. 29861/59. Ten/44069.)*

Egypt.—Cairo Electricity and Gas Administration. 20th April. Two 60 MW turbo-alternators and four boilers. (E.S.B. 29639/59. Ten/44021.)*

Formosa.—Central Trust of China, Taipei. 19th January. Electric motors, substations and heat exchanger. (E.S.B. 29821/59/I.C.A. Ten/44044.)*

Gillingham (Kent).—Corporation. 18th January. Electrical switches and accessories, part I (Form No. 16); electrical conduit, part II (17); electrical wire, cables and accessories, part III (18); and electric lamps (19), for the year ending 31st March, 1961. Borough engineer, Municipal Buildings.

Great Yarmouth. — Corporation. 28th January. Electrical installation in new headquarters police station. Borough Engineer's Office.

Hayes and Harlington.—U.D.C. 18th January. Electric discharge lamps (Form No. 17); gas-filled general lighting service lamps and automobile lamps (18); medium and low voltage cables (21); time switches (28), for the year ending 31st March, 1961. Engineer and surveyor, Town Hall, Hayes, Middx.

Hertfordshire.—County Council. Applications are invited for inclusion on the list of contractors for electrical works. Clerk of the County Council, County Hall, Hertford.

India.—Madras State Electricity Board. 28th January. Power station lightning arrestors and special protective capacitors. (E.S.B. 29873/59. Ten/44050.)*

Directorate General of Supplies and Disposals, New Delhi. 16th February. Three 4,500 h.p. Francis turbines. (See this issue.)

Andhra Pradesh Government Electricity Department. 21st January. Insulators and accessories. (E.S.B. 29498/59. Ten/44089.)*

Iraq.—Directorate of Contracts and Purchases, Ministry of Defence, Baghdad. 1st February. Overhead and underground telephone cable. (E.S.B. 30083/59. Ten/44095.)*

Manchester.—Corporation. 25th January. 6,600 V cables, road lighting and telephone cables at Davyhulme sewage works extensions. (See this issue.)

Newcastle-upon-Tyne.—Corporation. Electrical installation and electric lifts for new town hall. (See this issue.)

New Zealand.—G.P.O., Wellington. 29th January. Wall-mounting electric heaters. (E.S.B. 29795/59. Ten/44048.)*

New Zealand Electricity Department. 14th June. Three 30,000 kW generators. (E.S.B. 29798/59. Ten/44020.)* Three Francis water turbines each of 42,000 b.h.p. (E.S.B. 29799/59. Ten/44061.)*

Norwich.—Corporation. 22nd January. Trunk road lighting equipment. (See this issue.)

Seaham (Durham).—U.D.C. 16th January. Electrical rewiring of 265 houses on the Deneside estate. Surveyor.

South Africa.—Stores Department, South African Railways, Johannesburg. 15th January. Electric cable, glands and joint boxes. (E.S.B. 29690/59. Ten/44023.)* Train lighting batteries. (E.S.B. 29689/59. Ten/44022.)* 22nd January. Outdoor h.v. circuit-breakers and protective equipment. (E.S.B. 30115/59. Ten/44107.)*

Durban Corporation. 12th February. Twelve 10 kVA, 6,600/400 V, 3-phase transformers and twelve 10 kVA, 11,000/400 V, 3-phase transformers. (E.S.B. 29430/59. Ten/43976.)*

Swansea.—Corporation. 23rd January. Electric lamps, electric cable and public lighting equipment for one year to 31st March, 1961. Borough engineer and surveyor, Guildhall.

Thailand. — Metropolitan Electricity Authority, Bangkok. 15th January. 162 distribution transformers, ranging from 5 kVA to 333 kVA. (E.S.B. 29628/59/I.C.A. Ten/44038.)* 22nd January. All-aluminium conductor cable, bare copper conductor and guy strand. (E.S.B. 30041/59/I.C.A. Ten/44077.)*

Wembley.—Borough Council. 25th January. Electric lamps (Form No. 9) for the year ending 31st March, 1961. Borough engineer and surveyor, Town Hall.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Amlwch.—Houses (26), Tan-y-Bryn site; J. Isgoed Williams, architect, Pant-yr-Afon, Penmaenmawr.

Antrim.—Technical school, Whiteabbey (£300,000); Education Offices, County Courthouse, Belfast.

Bangor (Co. Down).—Grammar school, Castle Park (£155,000); Education Offices, 1, Wellington Place, Belfast.

Bedford.—Phase 3 of Mander College (£77,051); Winton Hayes, Ltd., Biggleswade.

Belfast.—Bus terminal, Oxford Street, for Ulster Transport Authority (£80,000); Smith & Cowser, architects, 31, College Gardens, Belfast.

Benton.—Five blocks of three-storey buildings for Northern Counties Training College; F. W. Harvey, architect, 1, Lansdowne Terrace East, Gosforth.

Blaydon (Co. Durham).—Factory, offices and canteen, Chain Bridge Road, for Boyd & Co., Ltd.; Wetherell, Lamb & Partners, 24, Picton Place, Newcastle-on-Tyne.

Bromham.—Extensions and improvements to primary school (£20,460); county architect, Bedford.

Cardiff.—Store extensions (£125,000) for James Howell & Co.; John Morgan, Ltd., builders, Cathedral Road.

Chesterfield.—School, Storrs Road (first stage £30,000); borough surveyor.

Cockermouth.—Houses (30) for North Eastern Housing Association; John Twiname, Ltd., builders, Brigham, Cumberland.

Coventry.—Works, Charter Avenue; W. W. Curtis, Ltd., Cheylesmore Press.

Croydon.—Fire station, Old Town and Duppas Hill Lane; borough engineer.

Dewsbury.—Houses (119), Thornhill Lees; borough architect.

Dublin.—Rebuilding of the Abbey Theatre (£250,000); Michael Scott & Partners, architects, 19, Merrion Square.

New College of Technology, Lower Kevin Street (estimated cost £1,000,000); Hooper & Mayne, architects, 19, Upper Merrion Street.

Glasgow.—Works, Milnbank area; John Smyth & Sons, Ltd., 122, Clyde Street.

Office block, Clifton Place; Whatlings, Ltd., 10, Woodside Crescent.

London.—Block of flats, St. John Street, Clerkenwell; Daniel Watney, Eiloart, Inman & Nunn, architects, Charterhouse, E.C.1.

Extensions to London School of Economics, Houghton Street, Holborn (£260,000); Holland & Hannen and Cubitts, Ltd., 1, Queen Anne's Gate, S.W.1.

Office block, 133/150, Blackfriars Road, Southwark; Bernard Sunley & Sons, Ltd., 25, Berkeley Square, W.1.

Middlesbrough.—Proposed development of new suburb at Hemlington; J. T. Bell & Sons, builders, Market Street Chambers, Newcastle-on-Tyne.

Oldham.—Works extensions for Meters, Ltd.; Young & Purves, architects, 32, The Crescent, Salford.

Oxford.—Five-storey buildings, University College; Robert Matthew & Johnson-Marshall, architects, 24, Park Square East, London, N.W.1.

Peterhead.—Houses (50), Clerkhill estate; burgh surveyor.

Plymouth.—Works extensions; Bush Radio, Ltd., Ernesettle Road.

Pulborough.—Primary school, Storrington; West Sussex county architect, County Hall, Chichester.

Romford.—Commercial garage; Bradys Motors, Ltd., 137, London Road.

St. Albans.—Factory and offices; Blakeney & Strange, Ltd., 88, Park Street Lane.

Sandwich.—Laboratories, Ramsgate Road; Pfizer, Ltd., 137, Sandgate Road, Folkestone.

Southend-on-Sea. — Fifteen-storey office block, Victoria Avenue; P. F. Burridge, architect, 30, Alexandra Street.

South Shields.—Factory for A. L. Surtees, and printing works for Murray Hearne, Ltd.; Atcost, Ltd., contractors, 66, Duke Street, Darlington.

Stockton-on-Tees.—St. Andrew's Methodist Church; G. Fordy & Sons, contractors, Boathouse Lane, Stockton-on-Tees.

Stoke-on-Trent.—Project for four-storey town hall, new concert hall, three main shopping precincts, etc., Hanley; J. R. Piggott, city architect, Kingsway Chambers, Kingsway.

Sunderland. — Factory, Wear Street (£250,000), for Jackson Associated Manufacturers, Ltd., Leeds; Stephenson, Gillis & Partners, Saville Chambers, North Street, Newcastle-on-Tyne.

Taunton.—Extensions, Queen's College; Edward D. Mills & Partners, architects, 9/11, Richmond Buildings, Dean Street, W.1.

Walsall.—Training college for teachers at Gorway (£600,000); M. E. Habershon, borough engineer.

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* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

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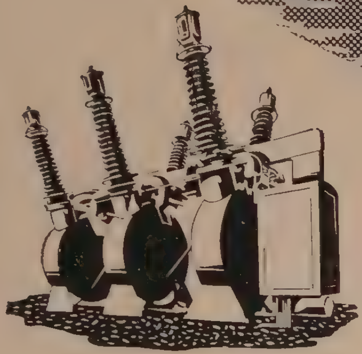

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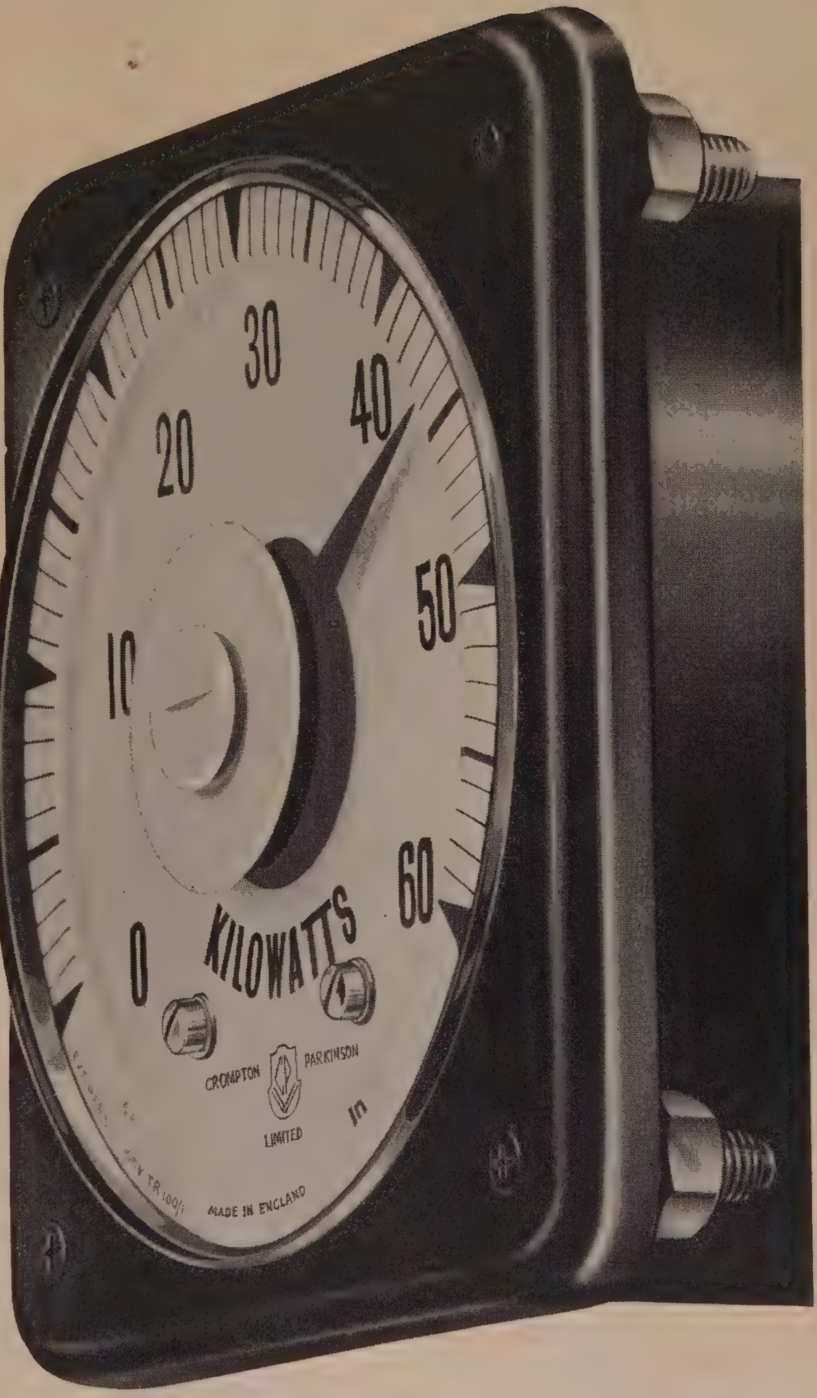

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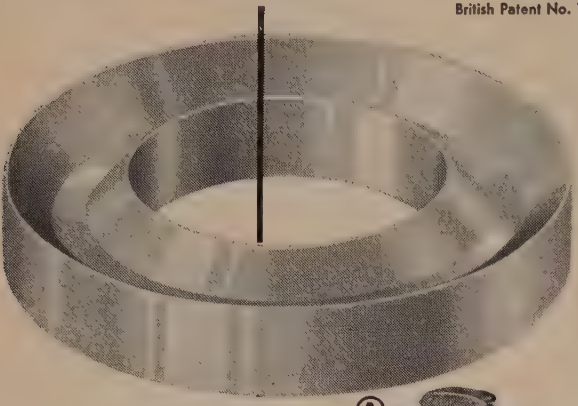

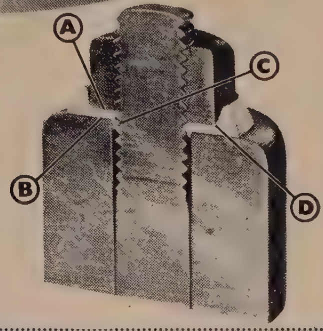

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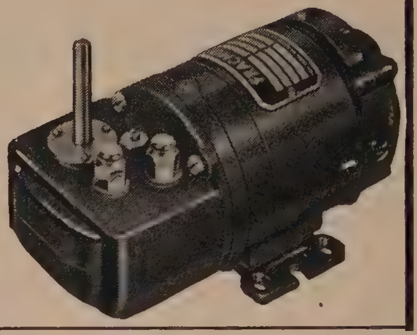

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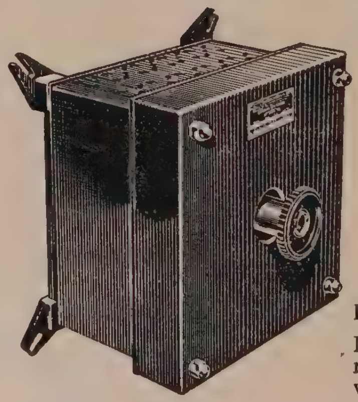

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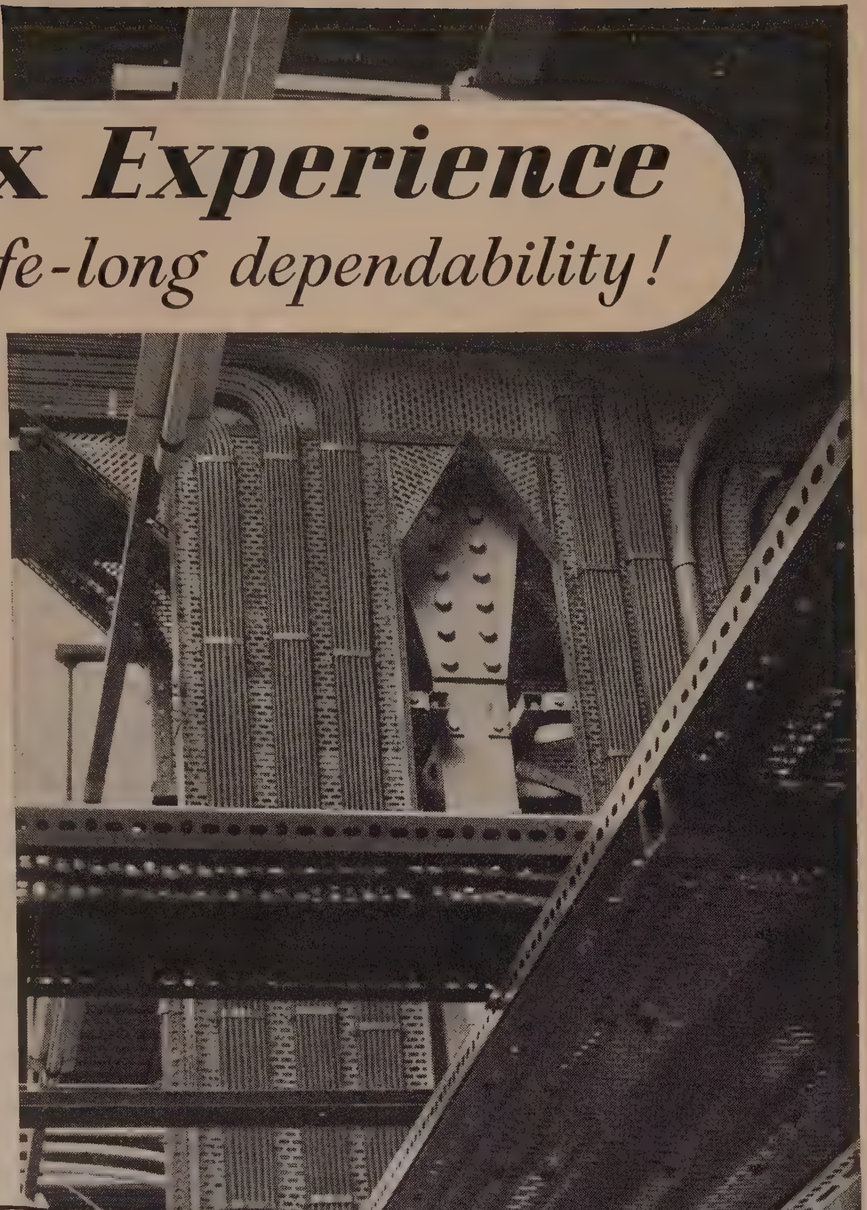

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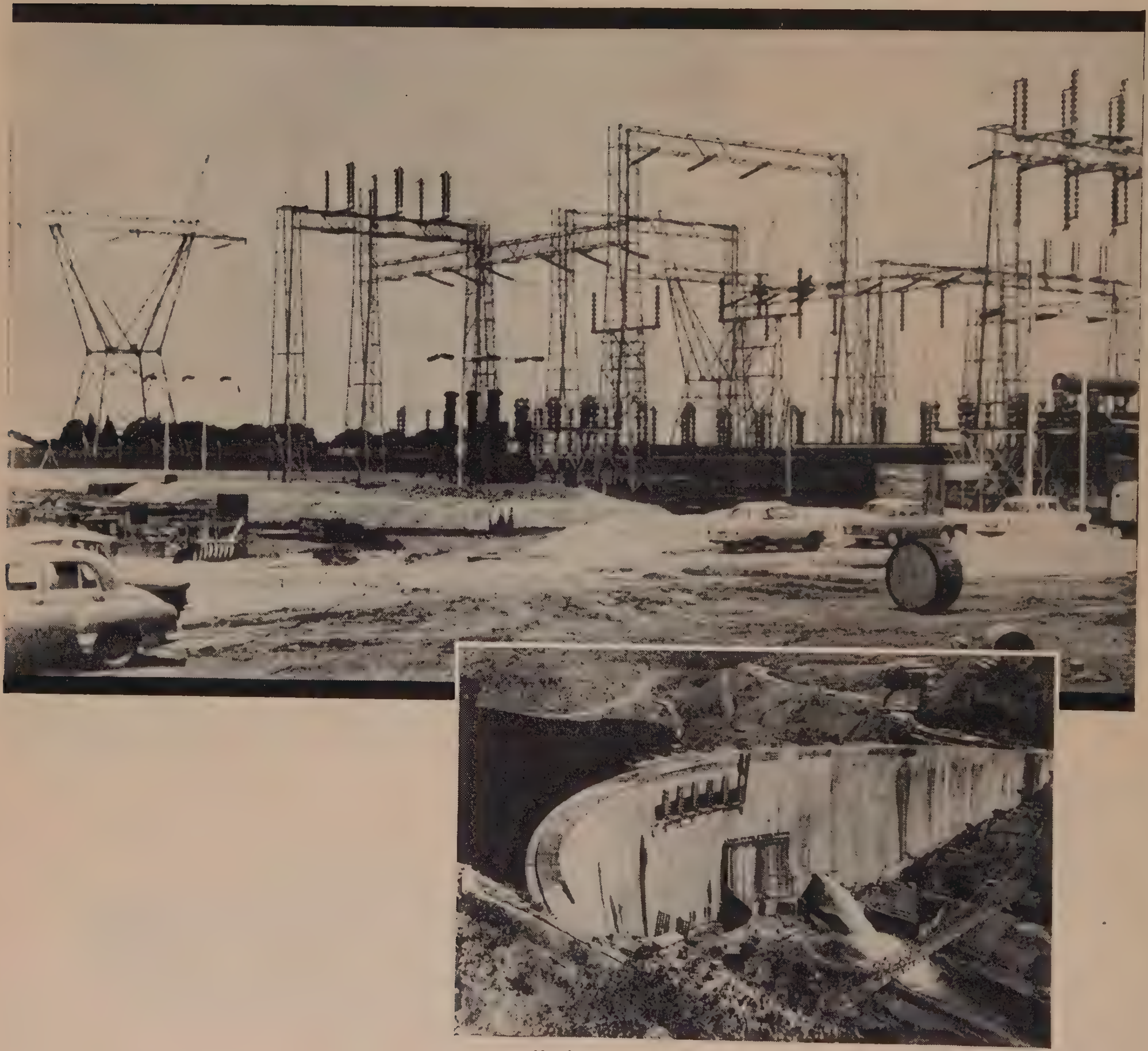

Kariba Dam. (Photograph by courtesy of the Office of the High Commissioner for Rhodesia and Nyasaland.)

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,,	,,		QR/30 ...	...	10	6	7
,,	Colour		QR/20 ...	...	8	11	2
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,,	2kW		602 ...	...	3	11	0
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,,	3kW		234 ...	...	7	19	9
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,,	2kW	Log	159a ...	...	12	5	7
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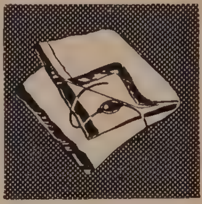

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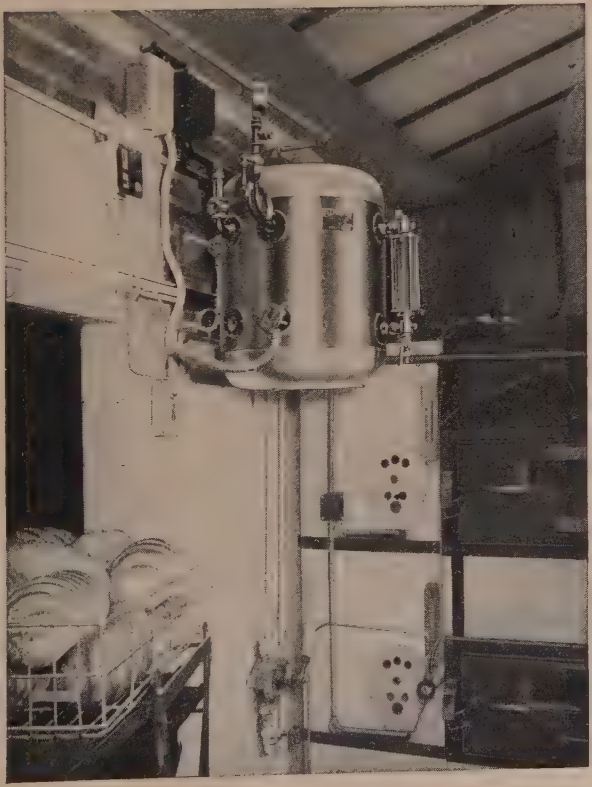

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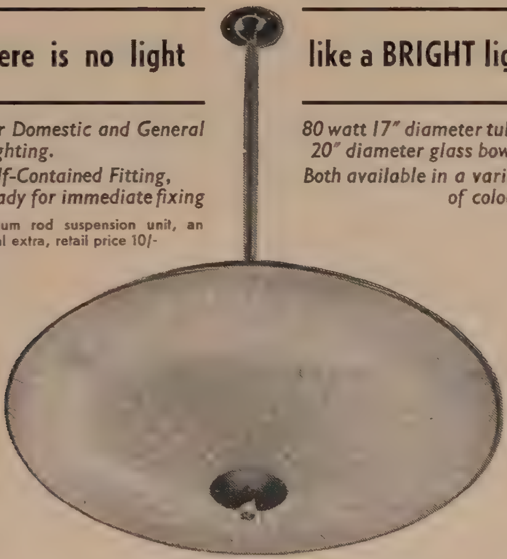

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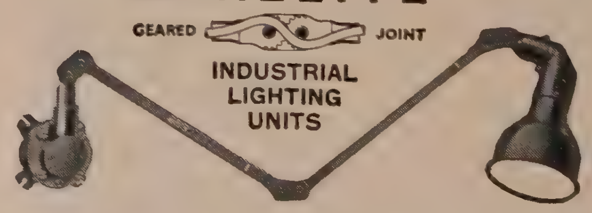

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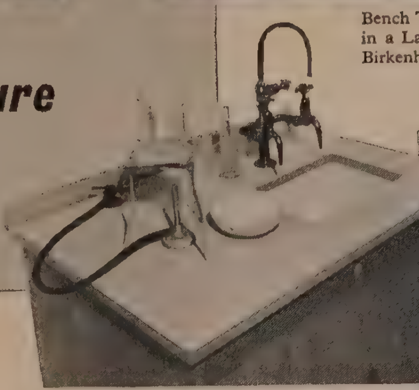

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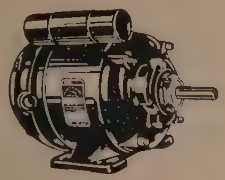

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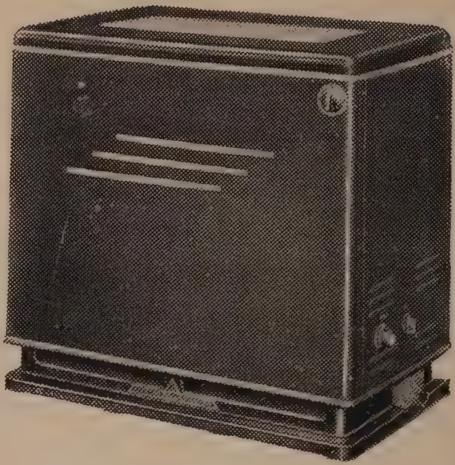

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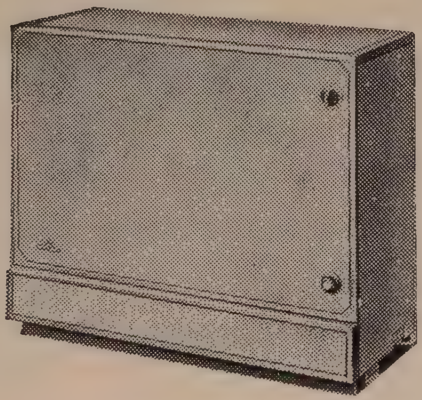

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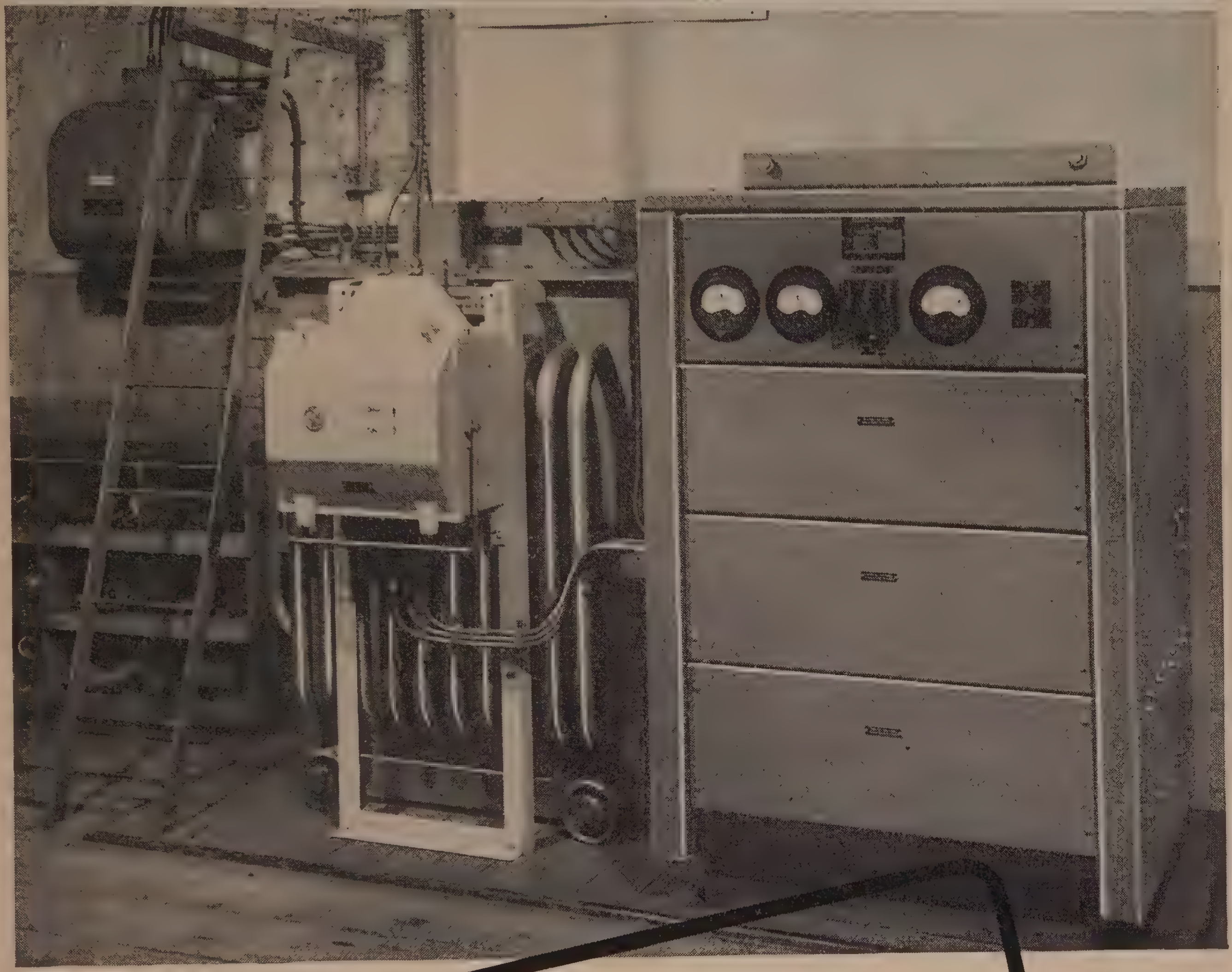

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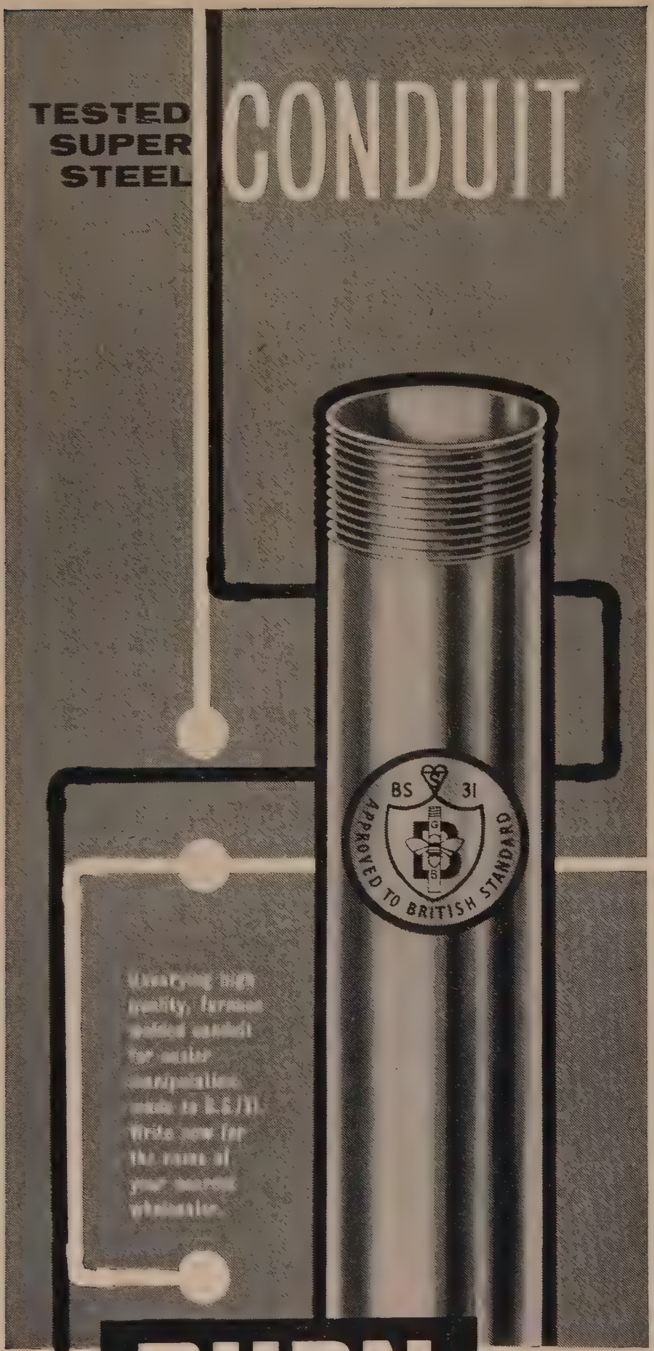

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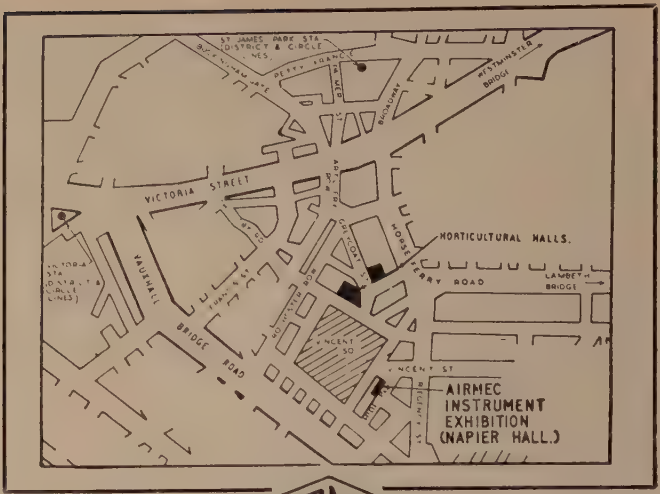

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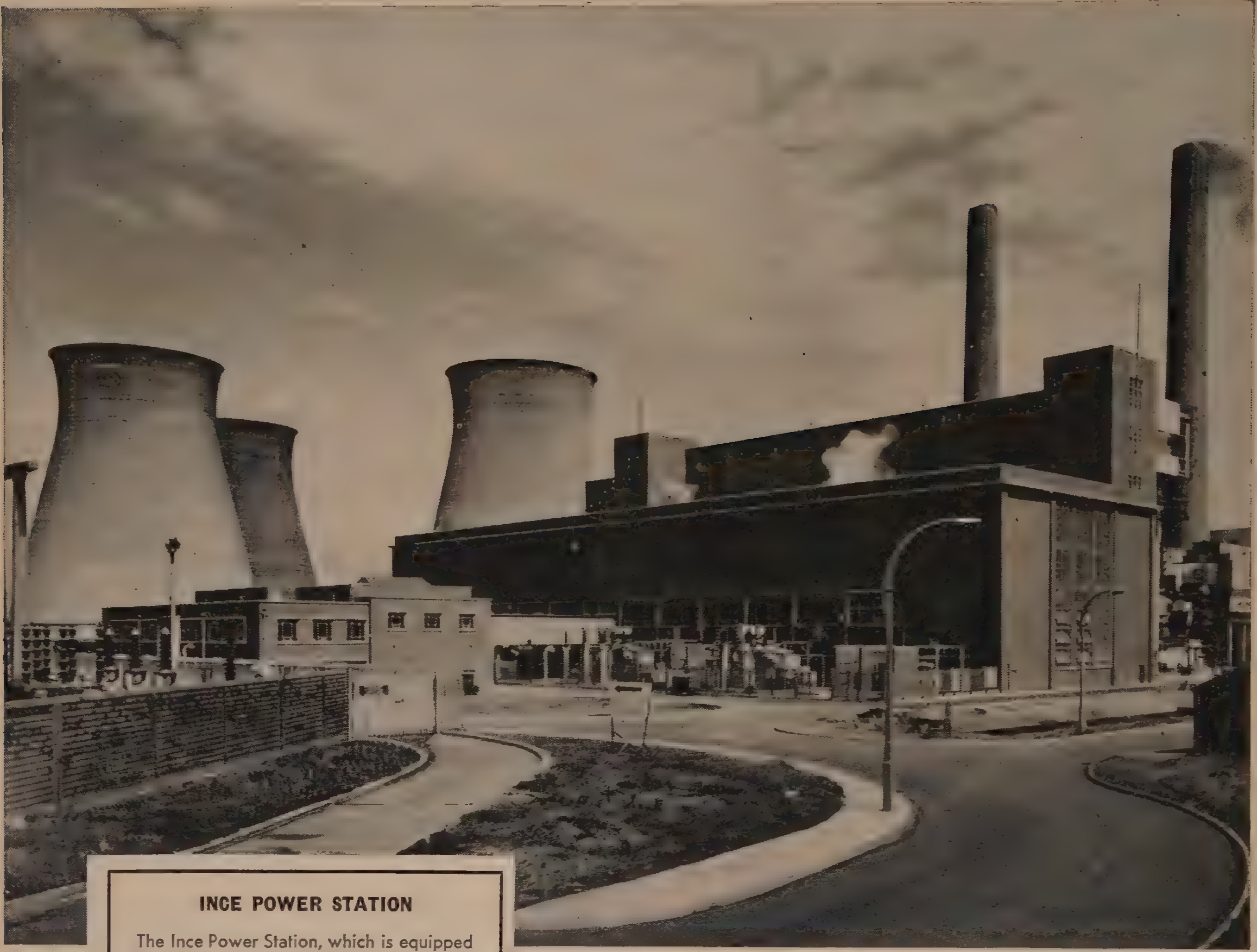

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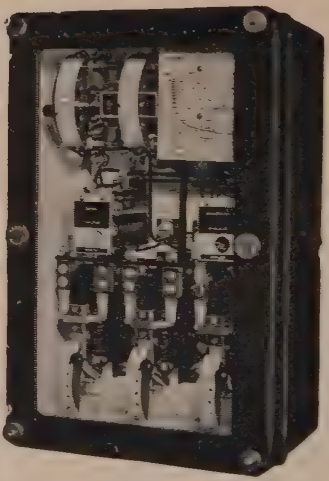
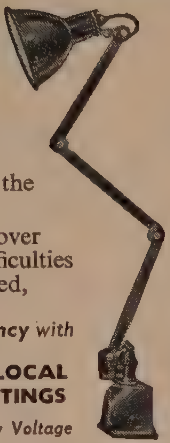


Lighting can be tricky ....



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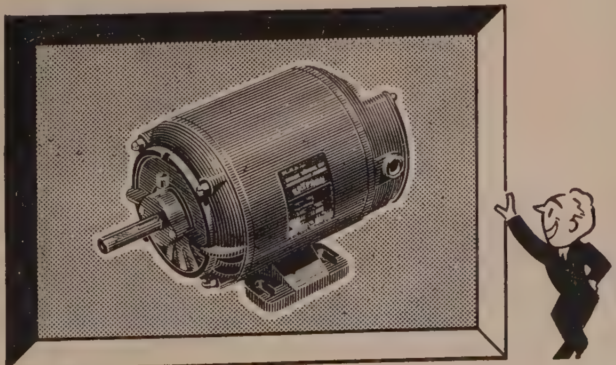

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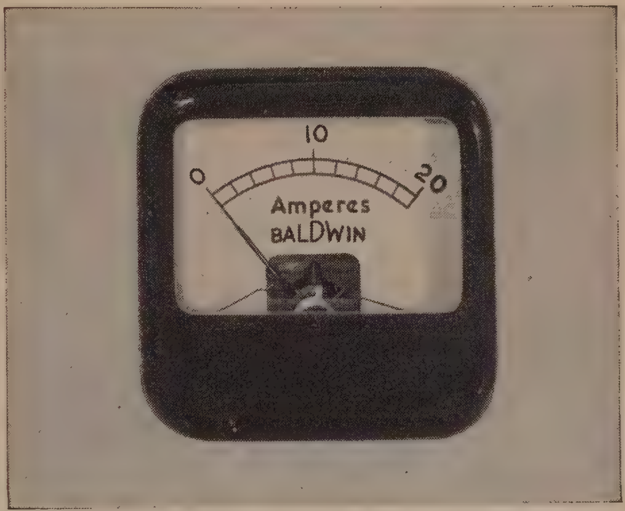

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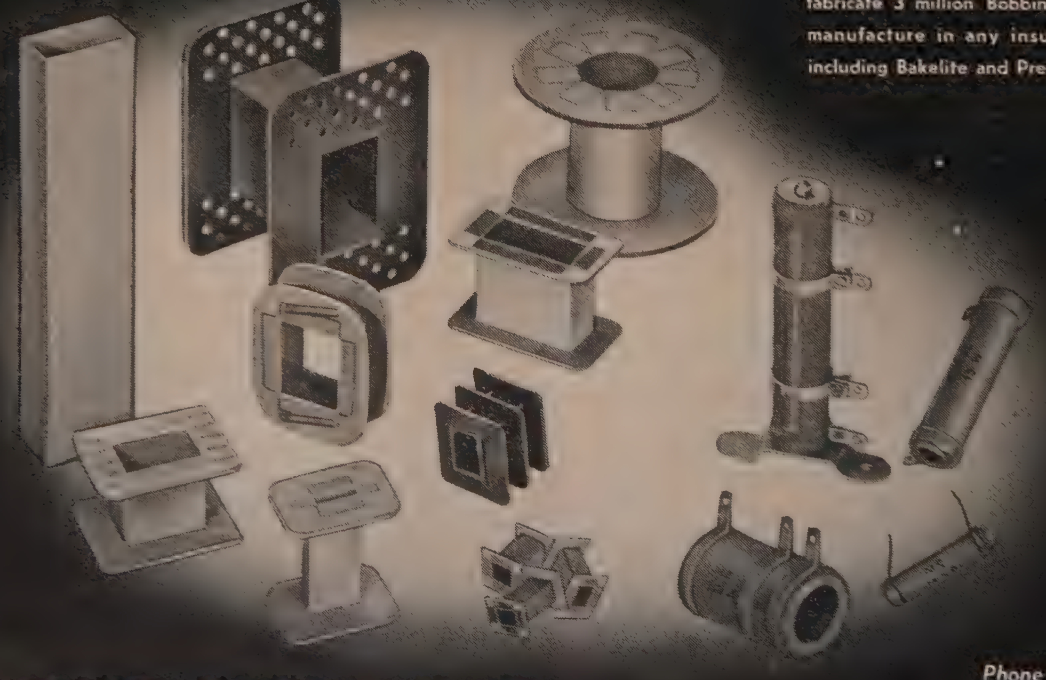

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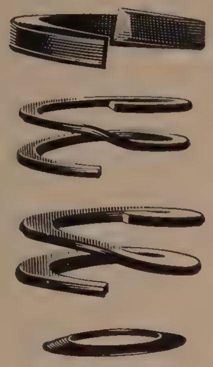

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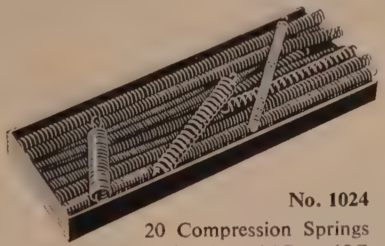

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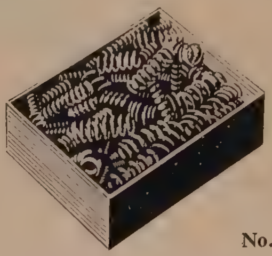

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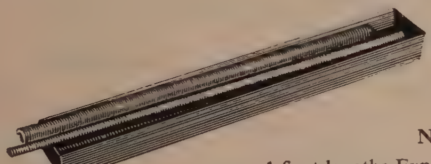

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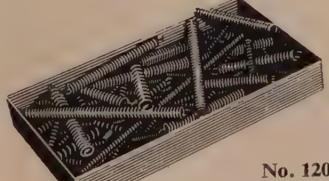

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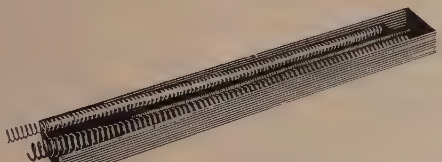

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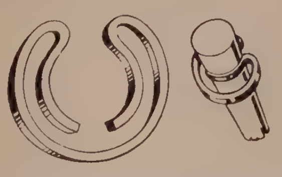

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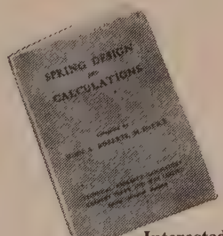

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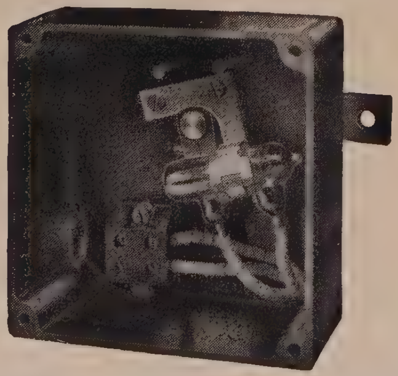

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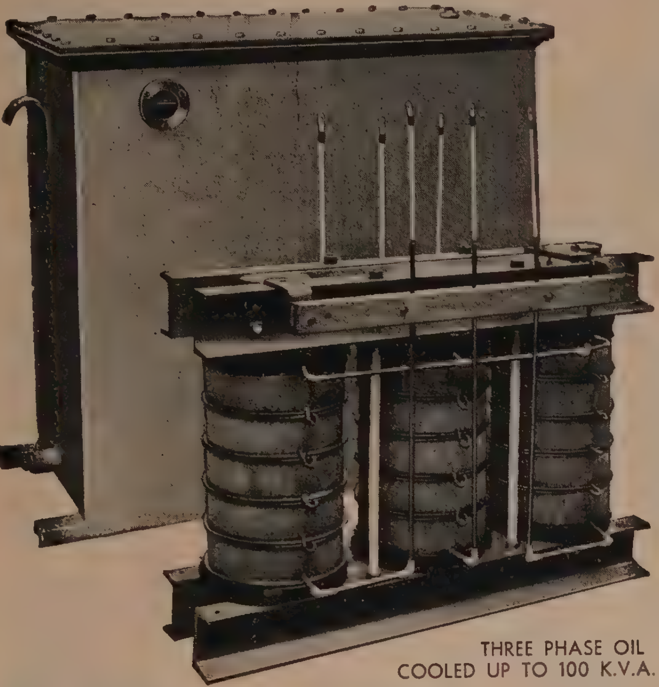

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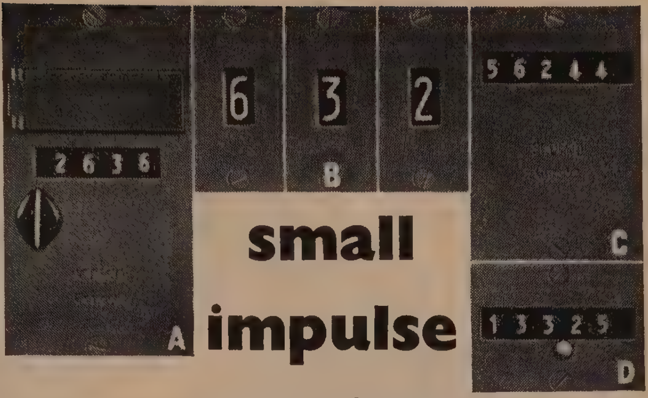

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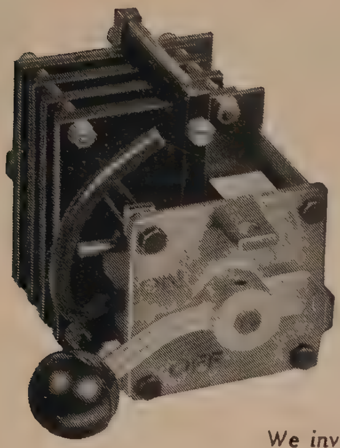

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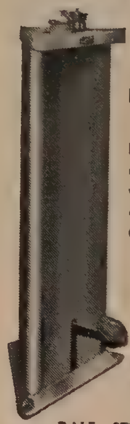

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Ideal for production work on wide range of insulated wires and small flexible cables up to ¼" outside dia. One quick foot movement gives accurate strip.

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One squeeze of the handles grips, cuts and strips insulation. Blades interchangeable to suit particular requirements. No crushing or splaying of wire. Cutting edges shielded for users' safety.

Obtainable from all good Tool Dealers or directly from makers. All parts easily replaceable.

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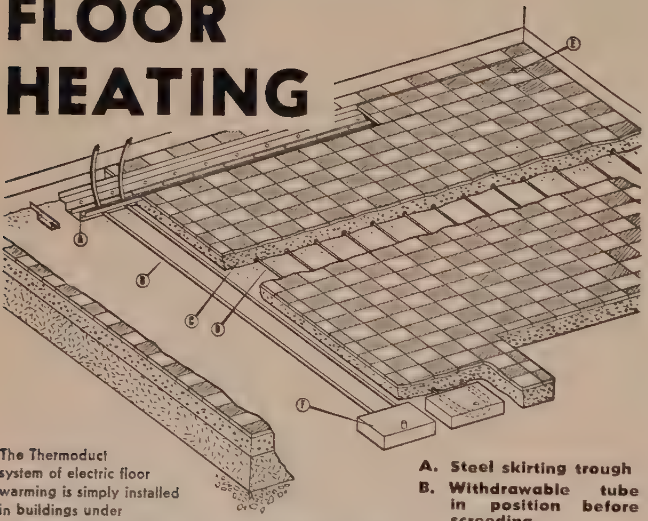
THERMODUCT FLOOR HEATING



The Thermoduct system of electric floor warming is simply installed in buildings under construction, employs components of unrivalled quality, costs less, and gives effective heating **where it does most good.** Thermoduct heating is invisible and operates on low "off peak" tariffs. It eliminates boiler houses, flues, fuel store problems, fuel dust, etc. It saves space, money and worry!

- **A. Steel skirting trough**
- **B. Withdrawable tube in position before screeding**
- **C. Screed**
- **D. Heating cable**
- **E. Removable cover**
- **F. "Turnround" block for runs of more than 20 ft**

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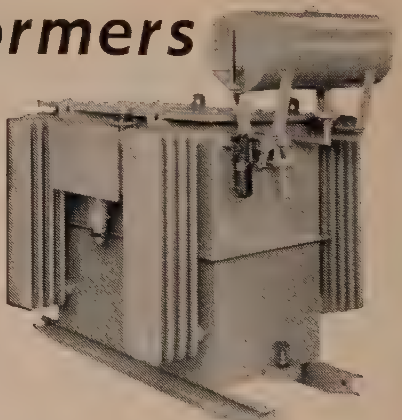
Transformers by Sturdy

FROM 500 VA TO 200 kVA

REGULARLY SUPPLIED TO NATIONAL COAL BOARD, CENTRAL ELECTRICITY GENERATING BOARD, AND MANY OTHER LARGE INDUSTRIAL UNDERTAKINGS



Typical 200 kVA Transformer

ALSO

Power Transductors

FOR FINGER-TIP MANUAL OR AUTOMATIC CONTROL OF POWER UP TO 500 kVA

Sturdy ELECTRIC CO. LTD.
HAMSTERLEY COLLIERY
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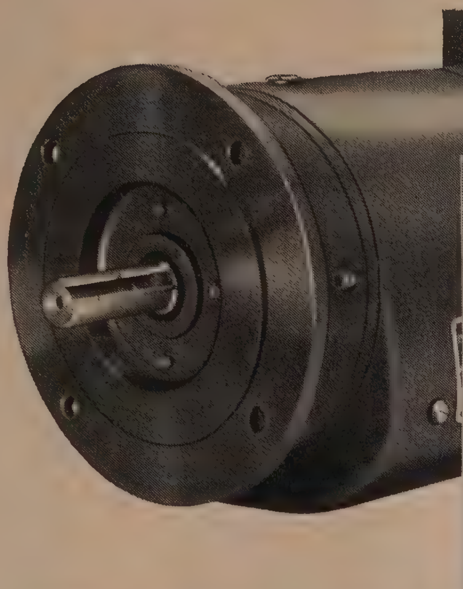
PHONE: EBCHESTER 271/2 TELEGRAMS: STURDITRAN, NEWCASTLE-UPON-TYNE

flange mounting geared motors

All NECO co-axial geared motors can be supplied with flange mounting instead of feet to enable the unit to be bolted accurately to your machine.

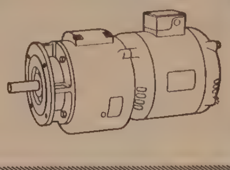


TYPE DS

Up to 1/2 h.p. input or up to 100 lb.ft. output torque. 0.5 to 475 r.p.m. 8" diameter flange. Removable feet can be supplied with this unit.

TYPE HD

Up to 2 h.p. output or up to 200 lb.ft output torque. 0.62 to 480 r.p.m. 8″ diameter flange.



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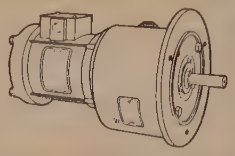

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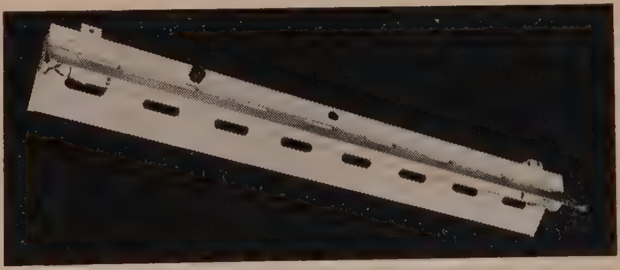
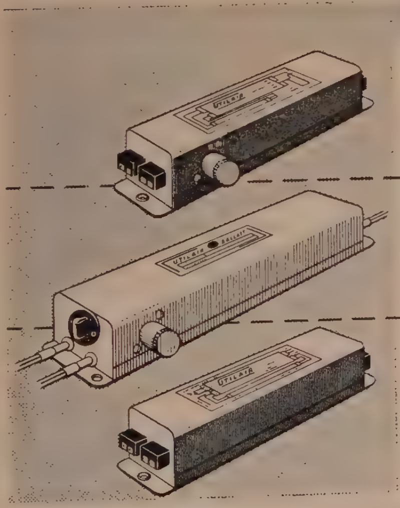


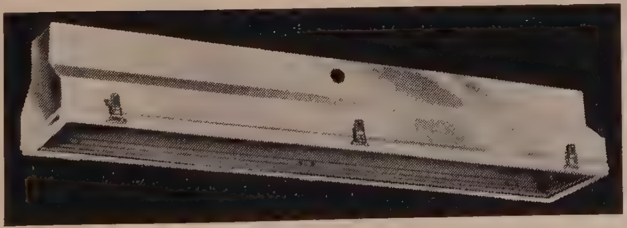
Model SSV.80 Industrial metal trough—slotted top



Starter switch type choke incorporating starter holder.

Starter switch type high power factor ballast unit.

Choke with instant start transformer unit.



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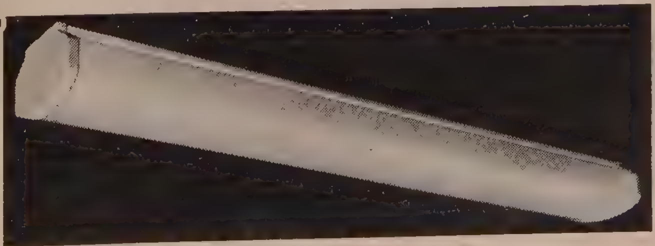

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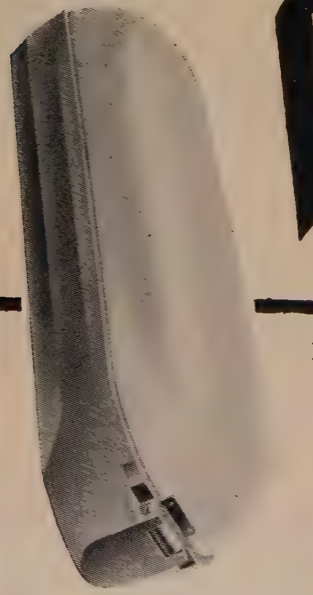

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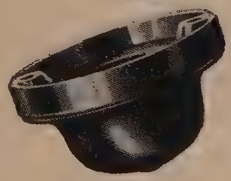

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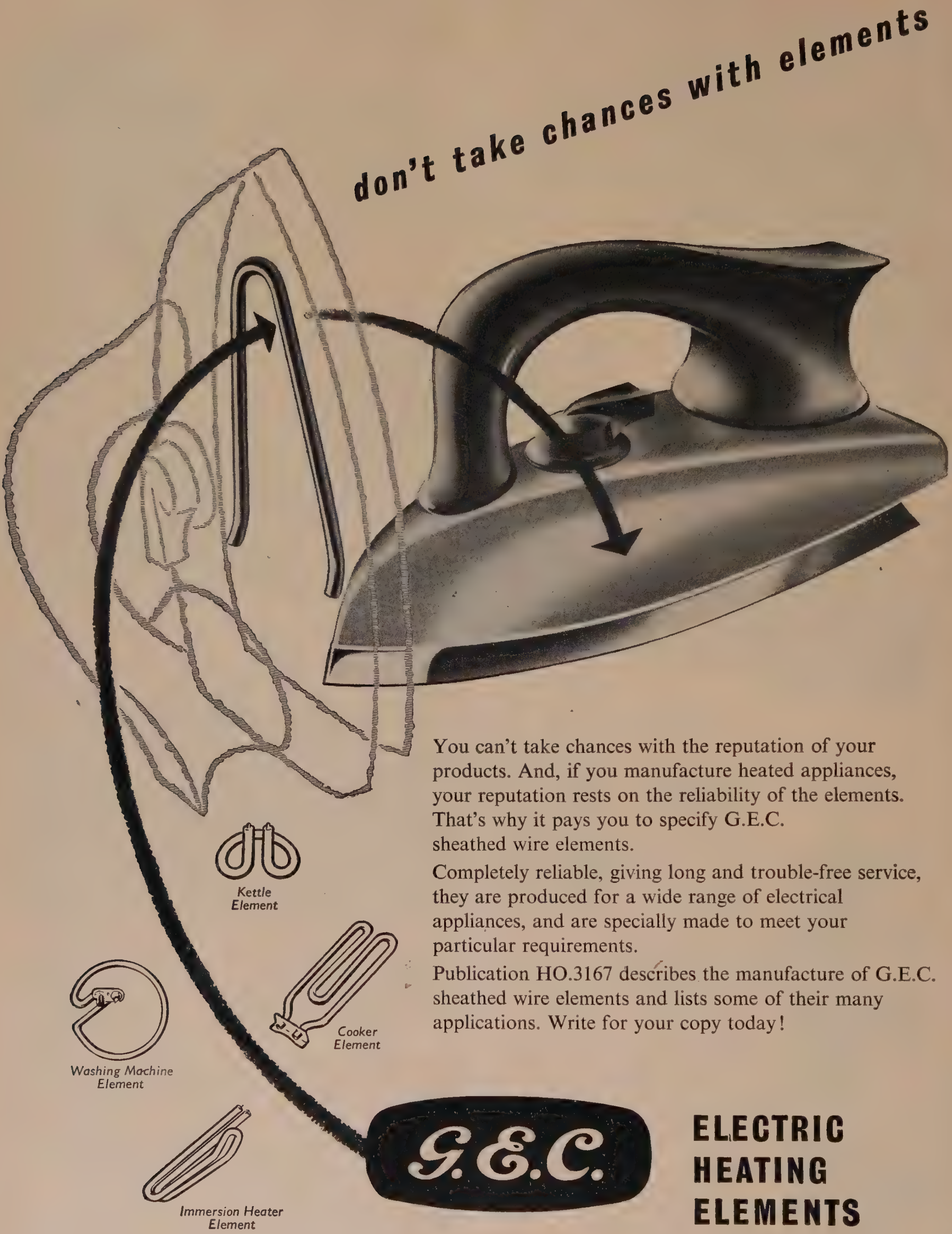

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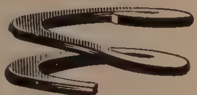
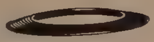

Standard Double Coil No.54.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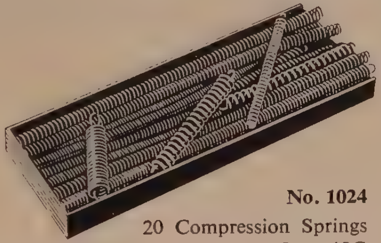
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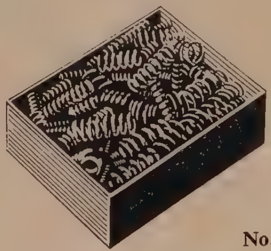
20 Compression Springs 12″ long. ⅛″ to ½″ diam. 24G to 18G suitable for cutting into shorter lengths; and 30 Expansion 1½″ to 12″ long. 5/32″ to ⅝″ diam., 22G to 16G. **24/- each.**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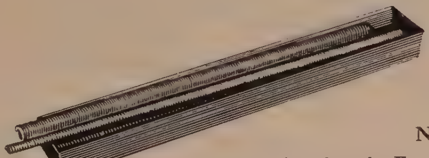
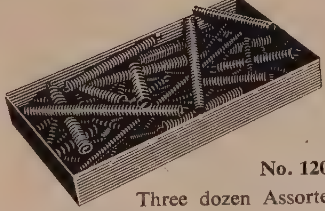

No. 761

1 foot lengths Expansion Springs suitable for cutting into shorter lengths. Assorted diameters from ⅛″ to ½″ and 24 to 16 S.W.G. **7/6 per box containing 1 dozen lengths.**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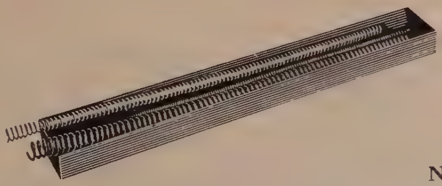
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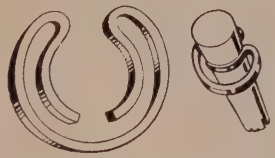
1 foot lengths Compression Springs suitable for cutting into shorter lengths. Assorted diameters from ⅛″ to ½″ and 24 to 16 S.W.G. **4/6 per box containing 1 dozen lengths.**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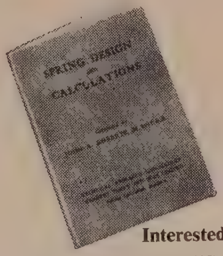

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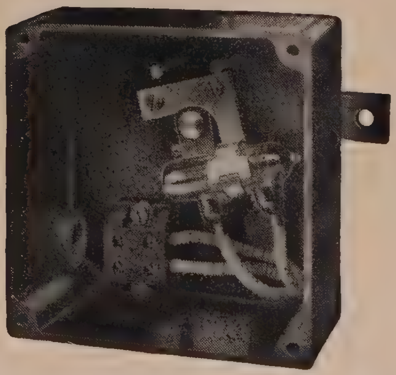

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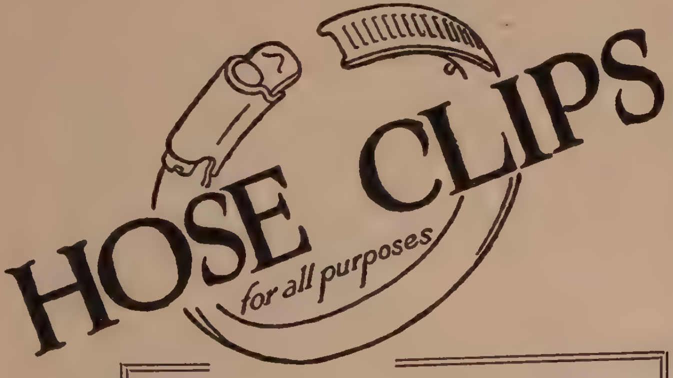

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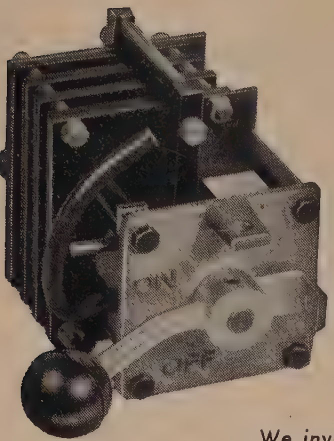

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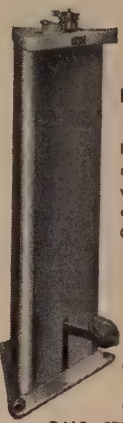

FOOT OPERATED WIRE STRIPPER

Ideal for production work on wide range of insulated wires and small flexible cables up to ¼" outside dia. One quick foot movement gives accurate strip.

E-Z WIRE HAND STRIPPER

One squeeze of the handles grips, cuts and strips insulation. Blades interchangeable to suit particular requirements. No crushing or splaying of wire. Cutting edges shielded for users' safety.

Obtainable from all good Tool Dealers or directly from makers. All parts easily replaceable.

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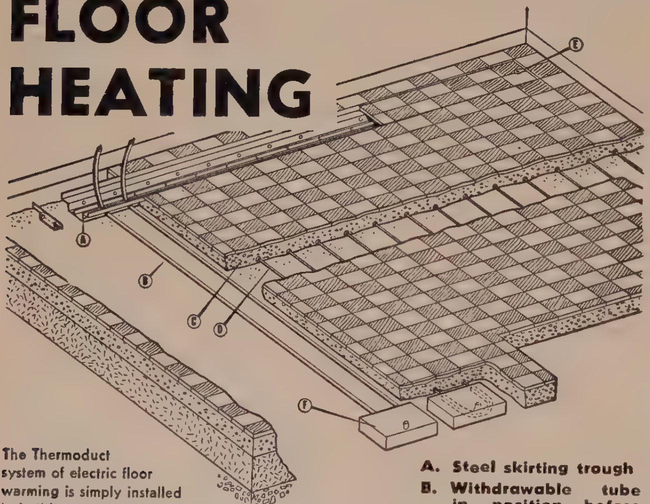
THERMODUCT FLOOR HEATING



The Thermoduct system of electric floor warming is simply installed in buildings under construction, employs components of unrivalled quality, costs less, and gives effective heating **where it does most good.** Thermoduct heating is invisible and operates on low "off peak" tariffs. It eliminates boiler houses, flues, fuel store problems, fuel dust, etc. It saves space, money and worry!

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- **B.** Withdrawable tube in position before screeding
- **C.** Screed
- **D.** Heating cable
- **E.** Removable cover
- **F.** "Turnround" block for runs of more than 20 ft

For full details write to:

THERMODUCT LTD.

Viaduct Works, Kirkstall Rd., Leeds 4

Phone: Leeds 29315 (3 lines)

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TO 200 kVA

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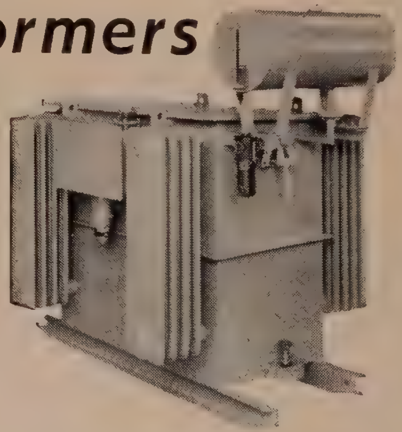

Typical 200 kVA Transformer

ALSO

Power Transductors

FOR FINGER-TIP MANUAL OR AUTOMATIC CONTROL OF POWER UP TO 500 kVA

Sturdy ELECTRIC CO. LTD.
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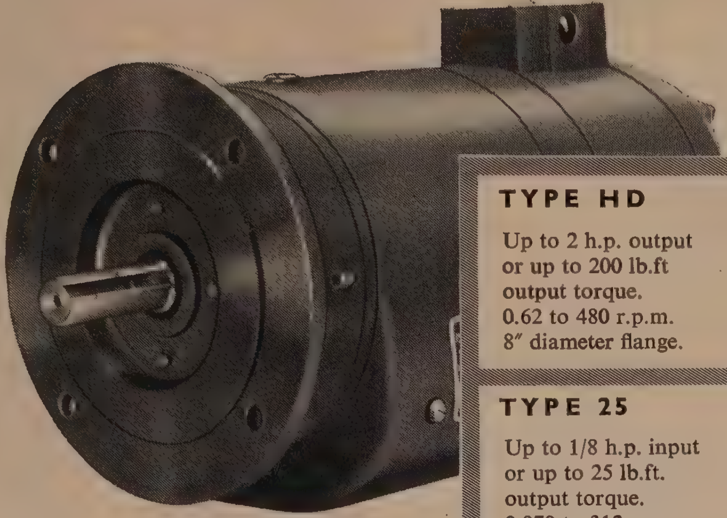
PHONE: EBCHESTER 271/2 TELEGRAMS: STURDITRAN, NEWCASTLE-UPON-TYNE

flange mounting geared motors

All NECO co-axial geared motors can be supplied with flange mounting instead of feet to enable the unit to be bolted accurately to your machine.

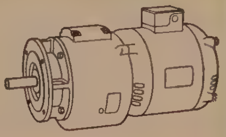


TYPE DS

Up to 1/2 h.p. input or up to 100 lb.ft. output torque. 0.5 to 475 r.p.m. 8" diameter flange. Removable feet can be supplied with this unit.

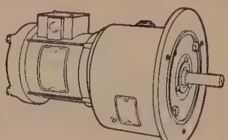
TYPE HD

Up to 2 h.p. output or up to 200 lb.ft output torque.
0.62 to 480 r.p.m.
8″ diameter flange.



TYPE 25

Up to 1/8 h.p. input or up to 25 lb.ft. output torque.
0.079 to 312 r.p.m.
8″ diameter flange.



NECO TRADE MARK

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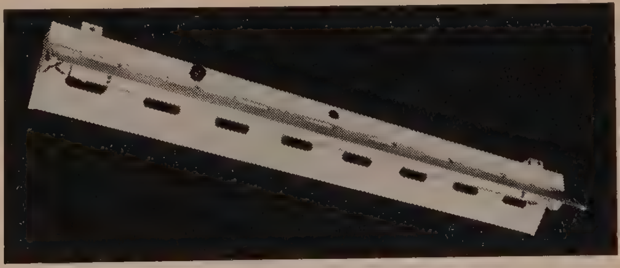
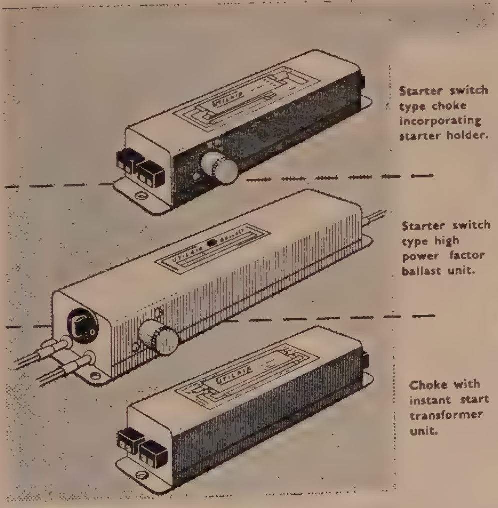


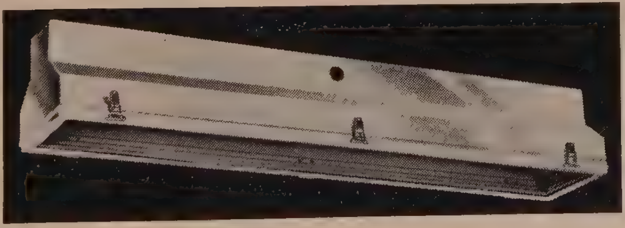
Model SSV.80 Industrial metal trough—slotted top



Starter switch type choke incorporating starter holder.

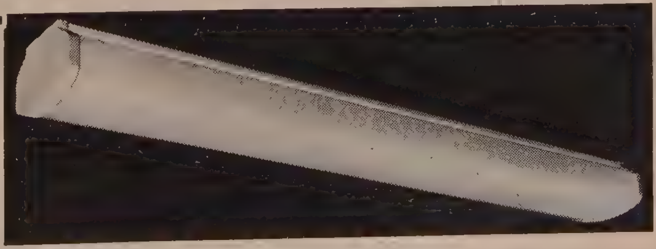
Starter switch type high power factor ballast unit.

Choke with instant start transformer unit.



Model VP.802 Industrial vapour-proof totally enclosed fitting

Britain's best range of Fluorescent Fittings selected for efficient lighting by famous concerns all over the world



Model EP.802 Suspended or ceiling fitting with opal fluted "Perspex" diffusing cover

UTILITIES (LONDON) LTD.
Manufacturing Electrical Engineers
TUNSTALL ROAD · BRIXTON
LONDON · S·W·9
Telephone : Brixton 6811-4
Telegrams : Utilon, London, S.W.9

ELECTRONIC SWITCH GEAR AND FUSE GEAR CASES

We are specialists in the manufacture of all types of electronic, switch control, and fuse gear cases. Standard cases in sheet steel, finished hammer grey stone enamel . . . or to your own specification. If you have any problems in this field please drop us a line.

Write to

WADES (Halifax) LTD.
FENTON ROAD, HALIFAX, YORKSHIRE
PHONE : HALIFAX 61637

Wafax

Introducing an entirely

NEW MINIATURE FLUORESCENT LIGHTING FITTING

COMPLETE WITH TWO 12-inch, 8-watt LAMPS

Consider these new and unique design features

Wherever a 25/40/60 watt tungsten filament lamp is now used here is a vastly superior fitting for all such applications.

1. Designed to comply with B.S.2467:1954.
2. Fully tested before and after fitting lamps.
3. Weatherproof and Dustproof.
4. Adequately protected against normal corrosion.
5. Perspex cover, for maximum light transmission and diffusion.
6. Uses modern low-loss chokes.
7. Fully power factor corrected.
8. Separate circuit for each lamp ensuring maximum availability.
9. Shrouded lampholders to accommodate lamps to American, European or British standards of tube diameter.
10. Lamp life 12 months or more when operated continuously.

Please see leaflet L300 for complete details.

Lampholder (Patent applied for). Design of Fitting (Registration applied for).

Victor

VICTOR PRODUCTS (WALLSEND) LTD. WALLSEND-ON-TYNE, ENGLAND.
Tel: Wallsend 68331 (6 lines) Cables: 'Victor' Wallsend, England.
London Office: 1327 London Road, Norbury, S.W.16 Telephone: Pollards 0077 (3 lines)
District Office Telephone Nos: Newport 62094. Stockport 5295. Doncaster 2515. Edinburgh 53987. Chesterfield 6222. Lichfield 2052.
From Wholesale Stockists throughout the British Isles.
MF/1

23,000 ELECTRICAL POINTS

IN THESE TWO ESTATES

Electrical Contractors
Curtis's 1693, High Street,
Knowle, Warwickshire

Pheasey Estate
Great Barr, Birmingham

Architect and Builder
Henry Boot & Sons (Midlands) Ltd.
Great Barr, Birmingham.

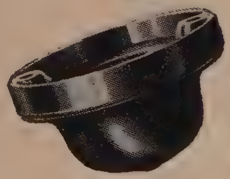
Wired throughout with "VOLEX" CABLES LAMPHOLDERS · CEILING ROSES

School Farm Estate
Sutton Coldfield

Architect and Builder
Compton Bros. Ltd.,
Enfield, Middlesex.

S.C.C.G.
LAMPHOLDER

BATTEN
LAMPHOLDER



CEILING
ROSE

Volex

Installations of this type demand a high standard of material. Volex Cables and Electrical Accessories were selected only after very careful consideration because they are known to give effective and trouble-free service.

Note to Electrical Contractors :

If you are tendering for competitive installations, our representative in your area would be pleased to give you details of our products.

VOLEX ELECTRICAL PRODUCTS LTD.
Telephone : PENDLETON 4373. SALFORD 6. Telegrams : VOLEXPROD Salford 6.

don't take chances with elements

You can't take chances with the reputation of your products. And, if you manufacture heated appliances, your reputation rests on the reliability of the elements. That's why it pays you to specify G.E.C. sheathed wire elements.

Completely reliable, giving long and trouble-free service, they are produced for a wide range of electrical appliances, and are specially made to meet your particular requirements.

Publication HO.3167 describes the manufacture of G.E.C. sheathed wire elements and lists some of their many applications. Write for your copy today!

G.E.C.

**ELECTRIC
HEATING
ELEMENTS**

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number there is an additional charge of 1/-.

DISPLAYED CLASSIFIED:—48/- per inch. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

Advertisements are accepted up to **first post on Monday** of the week of issue

If displayed with boxed rules, name or symbol block by **Friday** prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

PARISH OF CHURCHDOWN

Trunk Road Lighting

London-Fishguard Trunk Road T.R.10

TENDERS are invited for the supply and erection of a Group "A" Lighting Installation as follows :—

Bill No. 1. For the supply of 94 140-watt Sodium Aero-screened Lanterns, together with ancillary equipment.

Bill No. 2. For the supply and erection of 94 Steel Columns, together with fitting and wiring of tenderer's own lighting equipment.

Bill No. 3. As Bill No. 2, but for fitting and wiring of equipment offered by another firm.

Specification, bill of quantities and form of tender can be obtained from the undersigned on payment of a deposit of three guineas, which will be refunded on receipt of a bona fide tender not subsequently withdrawn.

Tenders together with fully priced bills of quantities are to be submitted in the envelope provided to reach the Clerk of the Parish Council, 106, Melville Road, Churchdown, Gloucester, not later than first post on Friday, 29th January, 1960.

The Council reserves the right to treat each bill of quantities as a separate tender and does not bind itself to accept the lowest or any tender.

J. V. WEBB,
Clerk of the Parish Council.
2802

CITY AND COUNTY OF NORWICH

Improvement of Street Lighting

Trunk Roads (a) A.11 Newmarket Road, (b) Thorpe Road and Main Traffic Route, (c) Harvey Lane

TENDERS are invited for :—

1. Supply of SO/H Lanterns. 62 200-watt size with control gear, 39 140-watt medium angle and 20 140-watt cut-off type.
2. Supply of Control Gear and Lamps. 60 200-watt lamps, 59 sets of 140-watt control gear and lamps.
3. Supply of 121 Tubular Steel Lamp Columns.
4. Erection and part connection 121 Columns, etc.

Tenders may be submitted for items 1, 2, 3 or 4.

Copies of the tender documents may be obtained from the City Engineer, City Hall, Norwich, Norfolk, NOR. 01A. Drawings may be inspected during normal working hours at the City Engineer's Office. Completed tenders are to be received no later than 10 a.m. on Friday, 22nd January, 1960.

The Council does not bind itself to accept the lowest or any tender. 2819

CITY OF MANCHESTER

Davyhulme Sewage Works Extensions, Stage 1B

TENDERS are invited for the installation of 6,600-volt Cables, Road Lighting and Telephone Cables.

Tender documents, obtainable from City Surveyor, Town Hall, Manchester, returnable by 25th January, 1960. 2803

INDIA STORE DEPARTMENT

THE Office of the Directorate-General of Supplies and Disposals, New Delhi, India, invites tenders for the following :—

Tender Enquiry No. Project/SE/4241K/I. For the supply of Three 4,500-h.p. Horizontal Francis Turbines complete with step-up Transformers, Switchgear, etc., for Trisuli Hydro-Electric Project, Nepal, India.

Specification, etc., relative to the above can be obtained from the Co-ordination Branch, India Store Department, Bromyard Avenue, Acton, London, W.3, at a cost of £4 10s. per tender, and is not refundable. Tenders are to be returned direct to the Directorate-General of Supplies and Disposals, National Insurance Buildings, Parliament Street, New Delhi, India, so as to reach them by 2.30 p.m. on 16th February, 1960.

Specimen copy of the above enquiry can be seen at India Store Department, Engineering Branch, Bromyard Avenue, Acton, London, W.3, under the following reference: S.3911/59/NSC/ENG. 2. 2850

CITY AND COUNTY OF NEWCASTLE UPON TYNE

New Town Hall

THE City Council invites Specialist Contractors possessing substantial organisation who are willing to submit a firm price tender for

(a) ELECTRICAL INSTALLATION
(b) ELECTRIC LIFT INSTALLATION

in the New Town Hall, and who wish to be considered for inclusion in a selected list of tenderers, to apply in writing in the first instance to the City Architect, 18, Cloth Market, Newcastle upon Tyne, 1, for particulars of the scope and magnitude of the work to be carried out.

Initial applications for more detailed information as to the work should reach the City Architect not later than the 23rd January, 1960.

JOHN ATKINSON,
Town Clerk.

Town Hall,
Newcastle upon Tyne, 1.
30th December, 1959. 2820

BOROUGH OF BARKING

Street Lighting

TENDERS are invited for the supply, delivery and erection of (a) 19 Class A Sodium lighting units on 25-ft. concrete or steel columns in Renwick Road, Barking; (b) The removal of 40 existing steel columns (22 being trolley poles) and supply, delivery and erection of 45 Class A Sodium lighting units on 25-ft. concrete or steel columns in Fanshawe Avenue and Longbridge Road, Barking.

Specification, bill of quantities and form of tender may be obtained from the Borough Engineer and Surveyor, Town Hall, Barking.

Sealed tenders, in the envelopes provided, must be delivered to the undersigned not later than 9 a.m. Wednesday, 13th January, 1960. The Corporation do not bind themselves to accept the lowest or any tender.

E. R. FARR,
Town Clerk.

Town Hall,
Barking, Essex.
2821

CLASSIFIED ADVERTISEMENTS ARE PREPAID

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

SECOND ASSISTANT ENGINEER required in Protective Gear Specialist Section of the Divisional Electrical Department, Bristol.

Superannuation scheme. Salary N.J.B. Class AX/DX, Grade 4, £1,180-£1,305/£1,410.

Applicants should possess qualifications leading to A.M.I.E.E. and should have a keen interest in modern forms of transmission and plant protective equipment. Experience in the design and application of protective systems together with a good knowledge of transmission theory is essential.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 15th January, 1960. 2855

THE ENGLISH ELECTRIC COMPANY LIMITED
BRADFORD

requires

Electrical and Mechanical Engineers

for responsible positions in their CONTRACTS DEPARTMENT This interesting work covers a wide field, including most industrial rotating machine applications, or the whole range of aircraft electrical and mechanical systems and equipment.

These vacancies offer good opportunities particularly for young men seeking a progressive career with a well-established organisation.

Commencing salaries dependent on ability and previous experience.

Please apply Dept. C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting reference ER.297F.

2795

A.E.R.E., HARWELL

requires

DRAUGHTSMEN

for work covering electronic, electrical, mechanical and instrumentation equipment and chemical plant connected with reactors.

Salary in range £585-£1,120 p.a.

Housing and superannuation schemes.

Send POSTCARD for full details to Group Recruitment Officer (1553/48), U.K.A.E.A., A.E.R.E., Harwell, Berks. 2793

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following positions within the Division :—

GENERAL ASSISTANT ENGINEER (Chemist), CASTLE DONINGTON POWER STATION (Vacancy No. 230/59/ER).

Candidates must have had a sound technical training and previous laboratory experience, and should preferably hold the Higher National Certificate in Chemistry, but consideration will be given to candidates studying for that qualification.

The salary will be in accordance with Schedule A of the National Joint Board Agreement and will be within the range £560-£700 per annum.

Closing date for receipt of applications, 15th January, 1960.

ASSISTANT ENGINEER (Instruments), LEICESTER POWER STATION (Vacancy No. 231/59/ER).

Applicants should have a good knowledge of instruments used in power stations and have had a sound technical training. Preference will be given to those possessing the H.N.C. or equivalent.

Salary will be in accordance with Class G, Grade 10 (£815 - £860 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 22nd January, 1960.

STATION SHIFT CONTROL ENGINEER, LINCOLN POWER STATION (Vacancy No. 232/59/ER).

Applicants should have a sound training and practical experience in a modern power station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be advantageous.

Salary will be in accordance with Class F, Grade 10 (£765 - £810 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 15th January, 1960.

SENIOR DRAUGHTSMAN, TRANSMISSION DEPARTMENT, DIVISIONAL HEADQUARTERS (Vacancy No. 235/59/ER).

The work is associated with H.V. electrical substations, etc., and experience on H.V. overhead lines or underground cable systems will be an advantage, but is not essential.

Salary will be in accordance with Grade 5 (£790-£890 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 22nd January, 1960.

THIRD ASSISTANT ENGINEER, TECHNICAL DEPARTMENT, DIVISIONAL HEADQUARTERS (Vacancy No. 236/59/ER).

Applications are invited for a position as Test Engineer in the Divisional Technical Department at Loughborough.

The successful candidate will be primarily concerned with light current equipment and he should have a thorough knowledge of electronics principles and practice. The duties will comprise tests and investigations both in the field and in the laboratory.

Preference will be given to candidates with Higher National or Degree qualifications in Electrical Engineering.

The salary and conditions will be in accordance with Schedule B Grade 6 (£925-£1,170 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 22nd January, 1960.

STATION SHIFT CONTROL ENGINEER, CASTLE DONINGTON POWER STATION (Vacancy No. 237/59/ER).

Applicants should have had a sound technical training and practical experience in a modern power station. The possession of a Higher National Certificate in Electrical Engineering, or its equivalent, would be an advantage.

Salary will be in accordance with Class L, Grade 10 (£1,025-£1,085 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 22nd January, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the dates stated.

O. S. WOODS,
Divisional Controller.

31st December, 1959. 2833

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Maintenance and Operation)
(Z.1024)

Swindon District of No. 2 (Newbury) Sub-Area. Salary N.J.B. Class F, Grade 10 (£765 × £15 to £810 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7, Oxford Road, Newbury, Berks., and returned to him quoting Z.1024 not later than 18th January, 1960.

Assistant Engineer (Maintenance and Operation)
(Z.1147)

Salisbury District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class F, Grade 11 (£710 × £15 to £755 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. Applicants should have had sound experience in electricity supply distribution and the possession of suitable technical qualifications would be an advantage.

General Assistant Engineer
(Z.1145)

Southampton District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class G, Grade 11 (£765 × £15 to £810 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in electricity supply distribution and the possession of suitable technical qualifications would be an advantage. The appointment will involve standby duties.

Applications for the last two appointments on form obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting the appropriate "Z" number, not later than 18th January, 1960.

The successful candidates for all three appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. 2856

DIELECTRICS

AN enthusiastic young electrical engineer or physicist required to undertake interesting experimental work on dielectrics and to be responsible for laboratory engaged upon control testing of same.

REPLIES FROM UNIVERSITY GRADUATES IN THEIR EARLIER TWENTIES WILL RECEIVE PARTICULARLY FAVOURABLE CONSIDERATION.

Situated in South-East England, the position is permanent, pensionable and carries a

Four-figure Starting Salary.

Write, stating age, qualifications and experience, to—Box 2827.

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

SECOND ASSISTANT ENGINEER (Operation and Maintenance). Applicants should have experience in the operation and maintenance of equipment at voltages up to 66 kV on both underground and overhead systems.

Corporate Membership of the Institution of Electrical Engineers or equivalent qualification is desirable.

The successful applicant will be required to assist in all matters affecting the operation and maintenance of the Sub-Area network.

Salary N.J.B. Class L, Grade 7, £1,270/£30/£1,360 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 22nd January, 1960.

No. 3 (Sheffield) Sub-Area

ROTHERHAM/MEXBOROUGH DISTRICT

INSTALLATION ENGINEER. Applicants should have served an apprenticeship and have been technically trained in electrical contracting work. Experience in varied classes of electrical contracting work, including tendering; preparation of specifications, and in the organisation and supervision of a large manual staff will be an advantage.

Salary N.J.B. Class K, Grade 8, £1,095/£25/£1,170 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 22nd January, 1960.

No. 1 (Bradford) Sub-Area

FOURTH ASSISTANT ENGINEER (Meters, Testing and Protection). Candidates should hold the Higher National Certificate in Electrical Engineering or an equivalent technical qualification. They must have had a sound training on metering, recording and indicating instruments, and protective relays of all types. A knowledge of power transformer testing and general testing of instruments and relays in substations would be an advantage.

Salary N.J.B. Class K, Grade 13, £815/£15/£860 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45/53, Sunbridge Road, Bradford, not later than 22nd January, 1960.

2851

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

Vacancies in Transmission Construction Section

No. 93B/9: THIRD ASSISTANT ENGINEER, DIVISIONAL HEADQUARTERS, KINGSTON, required to specify in detail equipment required for all types of transmission contracts; supervise the preparation of necessary layout drawings and schematic diagrams; conduct technical correspondence with contractors, etc. Candidates must be suitably qualified and experienced and have a thorough knowledge of contract procedure and conditions. Salary within range £975 - £1,190 per annum, including London allowance.

No. 237/9: THIRD or FOURTH ASSISTANT ENGINEER, NORTHFLEET TRANSMISSION DISTRICT, required to assist in office and site work concerning the construction of overhead lines, switchgear and transformers on the grid system. Candidates should possess at least H.N.C. (Electrical or Mechanical). Salary within range £890-£1,190, including London allowance.

Superannuation and sick pay schemes in operation.

Applications, giving all relevant details and quoting vacancy number, to Personnel Officer, Central Electricity House, Lower Ham Road, Kingston-upon-Thames.

Closing date 25th January, 1960. 2848

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Division

Appointment of Second Assistant Engineer, Electrical Measurements Section, Technical Department

APPLICATIONS are invited for the appointment of a SECOND ASSISTANT ENGINEER in the Electrical Measurements Section of the Technical Department with headquarters at Darlington. It is intended that the successful candidate shall be promoted to Senior Assistant Engineer, Grade 3, and take charge of the Section when the present Section Head retires in 1960.

Candidates should have a sound theoretical knowledge of electrical measurements and be Corporate Members of the Institution of Electrical Engineers. Responsible experience in a standardising laboratory and in the application of integrating meters and indicating instruments to large high-voltage circuits is required. Experience in the design of precision integrating meters and instrument transformers would be an advantage.

The salary for this appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule B, Grade 4, £1,180-£1,410, and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from any office of the Board or from Divisional Administrative Officer, Central Electricity Generating Board, North Eastern Division, Carliol House, Newcastle upon Tyne, 1, to whom they should be returned to arrive not later than 14th January, 1960. 2769

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

Mechanical Engineer

APPLICATIONS are invited for the appointment of MECHANICAL ENGINEER in the Regional Research and Development Department with headquarters in Leeds. The successful candidate, who will be responsible to the Regional Research and Development Officer, will be expected to co-operate with other sections in the Research Department, dealing with physics, chemistry, metallurgy and electrical engineering, and with other engineering departments engaged on operational work within the Region.

The duties will include the initiation, assessment and direction of various research and development projects associated with steam condensers, heat exchangers, pumps and design of large scale test rigs.

Candidates should have an Honours Degree in Engineering or equivalent qualification, and preferably some research and development experience.

The salary for the appointment, which is superannuable, will be in accordance with N.J.B. Agreement, Schedule B, Grade 2 or 3 (£1,365 to £1,740) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), North Eastern and Yorkshire Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 29th January, 1960. Envelopes to be endorsed "Confidential," quoting SVN.1/60. 2853

AEI

VACANCIES exist for TECHNICAL/COMMERCIAL ENGINEERS, with or without previous experience, to prepare schemes, tenders and handle contracts involving a wide range of electrical equipment. Personality is important, as the work involves direct contact with customers.

Some vacancies require a degree or diploma in engineering, but with others this is not essential.

Age preferably not more than 35.

Applications will be treated in strict confidence.

Write, with details of age, qualifications, experience and salary to :—

Divisional Commercial Manager
Motor & Control Gear Division
ASSOCIATED ELECTRICAL INDUSTRIES LTD.
Rugby

2786

ROYAL NAVAL SCIENTIFIC SERVICE

SENIOR SCIENTIFIC OFFICERS and SCIENTIFIC OFFICERS required in following localities :—

LONDON AREA: MECHANICAL ENGINEER with sound knowledge of basic principles of thermo and fluid dynamics to carry out research programme in particular field of applied hydrodynamics. Experience in modern methods of design and research on axial flow compressors, turbines or pumps an advantage. MECHANICAL ENGINEER for research on precision gear design. MECHANICAL ENGINEER for work on propulsion problems. APPLIED MATHEMATICIAN for research of basic nature on stability of underwater vehicles; knowledge of theoretical hydrodynamics and theory of control mechanisms an advantage. APPLIED MATHEMATICIAN or THEORETICAL PHYSICIST for acoustic analysis. APPLIED MATHEMATICIAN for work with electronic computers, with special reference to research into general underwater physical problems. ELECTRONIC PHYSICISTS for data handling and analysis problems. EXPERIMENTAL PHYSICIST for research in underwater acoustics. PHYSICIST interested in operation performance. CLASSICAL PHYSICISTS.

BALDOCK: PHYSICISTS or APPLIED MATHEMATICIANS for research in Metal or Quantum Physics.

PORTSMOUTH: PHYSICISTS with experience in field of microwave techniques. ELECTRONIC/ELECTRO-MECHANICAL ENGINEERS (experience in servo-mechanisms an advantage).

HASLEMERE: ELECTRONIC ENGINEER.

PORTLAND: PHYSICISTS or APPLIED MATHEMATICIANS for research in underwater acoustics. PHYSICISTS (general). ELECTRICAL ENGINEERS with advanced electronic design experience. MECHANICAL ENGINEERS. PHYSICAL CHEMISTS.

POOLE: CHEMICAL ENGINEERS. CHEMISTS with experience in rubber technology.

ROSYTH: MECHANICAL ENGINEER with experience in welding development. ELECTRONIC PHYSICISTS.

Candidates must normally be natural-born British subjects of natural-born British parents, with First or Second Class Hons. Degrees or equivalent qualifications. S.S.O.s must have had three years' postgraduate experience and be not less than 26 years of age.

Salaries (men): S.S.O. £1,233-£1,460; S.O. £655-£1,150 (London); somewhat lower in Provinces. Appointments unestablished (with F.S.S.U. benefits), but opportunities may occur for those under 32 to compete for established posts.

Forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1 (quote A.483/9A). 259

CENTRAL ELECTRICITY GENERATING BOARD

HEADQUARTERS DRAWING OFFICE

APPLICATIONS are invited for the following appointments at **Bankside House, Sumner Street, London, S.E.1** :—

A. **SENIOR DRAUGHTSMEN**—CIVIL, for R.C. foundations and light structures. **Salary scale £830 - £940 p.a.**

B. **SENIOR DRAUGHTSMEN**—ELECTRICAL, for work on 132-kV layout or diagrams, and/or with industrial heating and lighting experience. **Salary scale £830 - £940 p.a.**

C. **DRAUGHTSMEN**—CIVIL, for R.C. detailing. **Salary scale £660 - £780 p.a.**

D. **ILLUSTRATIVE DRAUGHTSMAN**—experienced on catalogue and illustrative work. **Salary within the range £565 - £740 p.a.**

Permanent/pensionable appointments. Staff restaurant. Sports and social club.

Applications in writing to, or application forms can be obtained from, the Personnel Officer, 24/30, Holborn, London, E.C.1. Envelopes should be marked "Confidential Ref. ER/490." 2787

TAYLOR CONTROLS LIMITED
75, Hale End Road
Walthamstow, London, E.17

requires an

INSTRUMENT ENGINEER

Internal Sales Engineer with extensive experience in the power, steel and gas industries. Will specialise in new range of electronic instruments and must have a wide knowledge of electrical and electronic techniques.

Applications to the Sales Director at the above address. 2807

HARRIS COLLEGE, PRESTON

Principal :
H. Wilkinson, M.Sc.Tech., Ph.D., A.Inst.P.

REQUIRED as soon as possible, ASSISTANT GRADE A to teach Radio and Television Servicing Work to Final City and Guilds Examinations, suitably qualified academically and with teaching and/or industrial experience. Salary scale £520 × £27 10s. to £1,000; point of entry dependent on previous teaching and/or industrial experience.

Forms from the Principal.

W. R. TUSON,
Clerk to the Harris Council.

2792

***Situations Vacant** (continued)*

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

Board Headquarters

SENIOR ASSISTANT (Personnel). Applicants should be young men of good educational background whose interests lie in industrial relations, to fill the above position. The person appointed will be given considerable scope to gain experience in the Personnel Section of the Secretary's Department where the range of functions include salary and wage negotiations, conditions of employment, personnel records, committee work and the consultative aspects affecting education, training, safety, health and welfare. The post affords an opportunity for a young man who has studied industrial relations to obtain practical experience. The conditions of the appointment will be in accordance with the National Joint Council for the Electricity Industry, and the salary Grade 5, £885/£960 per annum.

Applications, by letter, giving full details of age, qualifications, experience, present position and salary should be forwarded within 14 days to the Secretary, Midlands Electricity Board, Mucklow Hill, Halesowen, Nr. Birmingham.

Central Gloucestershire Sub-Area

THIRD ASSISTANT ENGINEER (Planning) (Headquarters). Duties will include assisting in the planning of 11-kV, 33-kV and 66-kV networks, preparation of technical reports, short circuit calculations, load flows and general technical duties. Technical qualifications desirable. Salary £965/£1,025 per annum (N.J.B. Grade K.10).

Apply, by letter, within 14 days, stating age, qualifications, experience, present position and salary to Mr. S. Raybould, Sub-Area Manager, Midlands Electricity Board, Eastern Avenue, Gloucester.

Shropshire and Herefordshire Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER (Ludlow). The successful applicant will be responsible to the District Manager for the efficient operation and administration of the Church Stretton Branch. Duties will include commercial development, consumers' service and sales of appliances, domestic and commercial, and contracting in the Branch Supply Area. Duties will also involve the operation of E.H.V. and L.V. mains and substations within the Branch. Appropriate qualifications will be an advantage. Salary £860/£905 per annum (N.J.B. Grade E.7). A self-contained flat is available if required.

Apply, by letter, within 14 days, stating age, experience, present salary and position, to Mr. W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury.

F. W. CATER,
Secretary. 2837

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

Third Assistant District Engineer
Lanark District

APPLICATIONS are invited for the appointment of THIRD ASSISTANT DISTRICT ENGINEER in the Lanark District. Applicants should possess the necessary technical qualifications and have had a sound engineering training with some experience in the operation and maintenance of H.V. and L.V. distribution systems, and should be conversant with load flow diagrams and voltage drop calculations.

The salary and conditions of service will be in accordance with the National Joint Board Agreement, Schedule A. The present classification and grading will be E.9, salary £765/£810 per annum. The successful candidate will require to reside within a reasonable distance of the District Offices at Lanark and to take standby duty in accordance with the above Agreement.

Application forms, which may be had from the undersigned, should be returned to this Office within 14 days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Crescent,
Hamilton.
2860

M.K. ELECTRIC LIMITED

invite applications for position of

ASSISTANT HOME SALES MANAGER

Applicants must have a good education and preferably a thorough knowledge of the marketing and distribution of Electrical Accessories. Previous experience as a Sales Representative is essential as well as experience in general Sales administration.

The position is permanent and pensionable and offers excellent future prospects.

Application giving full particulars of past experience, age and salary required will be treated in strict confidence if addressed to the

Home Sales Manager, M.K. Electric Ltd., Shrubbery Road
Edmonton, London, N.9

2734

YORKSHIRE ELECTRICITY BOARD

No. 3 (Sheffield) Sub-Area

ROTHERHAM DISTRICT

THIRD ASSISTANT DISTRICT ENGINEER. Applicants should have technical qualifications equivalent to Graduate Membership of the Institution of Electrical Engineers and have had experience in the work of a District Engineering Department.

Salary N.J.B. Class J, Grade 9, £965/£20/£1,025 per annum.

MEXBOROUGH DISTRICT

THIRD ASSISTANT DISTRICT ENGINEER. Applicants should have had experience in the work of a District Engineering Department. They should hold the Higher National Certificate in Electrical Engineering or an equivalent qualification.

Salary N.J.B. Class F, Grade 9, £815/£15/£860 per annum.

SUB-AREA HEADQUARTERS

GENERAL ASSISTANT ENGINEER (Meters, Testing and Protection). Applicants should have had a good all-round training in electrical engineering. Possession of the Higher National Certificate in Electrical Engineering is desirable.

Salary N.J.B. Class M, Grade 16, £765/£15/£810 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 15th January, 1960.

No. 5 (Wakefield) Sub-Area

CASTLEFORD DISTRICT

ASSISTANT CONSUMERS' ENGINEER. Applicants, who must have had a sound practical training and some experience in the work of a Consumers' Engineer, will be required to give advice to all classes of consumer concerning the utilisation of electricity. Experience in the interpretation of the I.E.E. wiring regulations, obtaining off-peak heating, loads, street lighting negotiations and tariffs will be of advantage.

Preference will be given to applicants holding a Higher National Certificate in Electrical Engineering or equivalent qualifications.

Salary N.J.B. Class F, Grade 10, £765/£15/£810 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a, Denby Dale Road, Wakefield, not later than 15th January, 1960.

2852

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:—

Birmingham and District Sub-Area

FIRST ASSISTANT DISTRICT ENGINEER (Sutton Coldfield and North East District).

Extensive experience necessary with H.V., M.V. and protective systems. Applicants should have technical qualifications commensurate with eligibility for associate membership of the I.E.E. Salary £1,470/£1,575 per annum (N.J.B. Grade K.4).

FOURTH ASSISTANT ENGINEER (Technical and Planning Section) (Headquarters).

The successful applicant will be required to assist in the design of the H.V. and M.V. systems, analysis of loading conditions, preparation of specifications and layout of plant and equipment. Technical qualifications desirable. Salary in accordance with N.J.B. Schedule A, Class M, Grades 13/12, £910/£1,025 per annum.

Apply by letter, within 14 days, stating age, experience, qualifications, present position and salary to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14, Dale End, Birmingham, 4.

F. W. CATER,
Secretary. 2804

ELECTRICAL MAINTENANCE SUPERVISORS

are required at

CALDER WORKS NUCLEAR POWER STATION

to be responsible for maintenance work on all sections of electrical equipment. Shift working will be involved as well as responsibility for certain aspects of shift maintenance.

Applicants must have served a recognised engineering apprenticeship and be experienced in the control of staff engaged on the maintenance of heavy electrical equipment. They should have a good knowledge of high and low voltage switchgear, large D.C. and A.C. rotating machines and associated control gear. Possession of an O.N.C. may be an advantage.

Salary scale £925 (at age 30) to £1,105 p.a. Contributory superannuation. Staff housing scheme.

Send POSTCARD for application form, quoting reference P./W.8/J7, to Recruitment Officer, Windscale Works, Sellafield, Seascale, Cumberland.

Closing date 1st February, 1960.

2824

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointment :—

GENERAL ASSISTANT ENGINEERS, RYE HOUSE GENERATING STATION.

Salary Class G, within the range of Grades 15/13, £560 × £15 to £700 per annum, plus 10% shift allowance when required to work on shift.

The commencing salary will depend upon the duties and responsibilities.

Duties include assisting in the electrical control room and experience in the technical operation of electrical, boiler house and turbine house plant, testing, etc. The posts will provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of Ordinary National Certificate or its equivalent will be an advantage.

Applications, quoting reference 2/11135, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts, to arrive not later than 16th January, 1960.

W. N. C. CLINCH,
Controller. 2847

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified electrical engineers for the following appointments, which are subject to N.J.B. Agreement for the Electricity Supply Industry :

1. Tyne Sub-Area

SENIOR ASSISTANT ENGINEER, Sub-Area Commercial Officer's Department, Sub-Area Headquarters, Newcastle upon Tyne.

Applicants should have wide experience of commercial practice and distribution in electricity supply, including development work in urban and rural areas.

Salary Schedule A, Class L, Grade 4, £1,600/£1,705 per annum.

2. Wear Sub-Area

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER, South Shields District.

Applicants should have experience in utilisation of electrical energy in commercial and domestic premises, knowledge of installation work, and be conversant with tariffs, sales and all aspects of consumer service.

Salary Schedule A, Class F, Grade 5, £1,025/£1,085 per annum.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, within ten days of the appearance of this advertisement. 2832

SOUTH WALES ELECTRICITY BOARD

District Engineer

APPLICATIONS are invited for the position of DISTRICT ENGINEER in the Cardiff District of the Cardiff and East Central Area of the Board.

The salary for the position will be in accordance with Class H, Grade 2 (£1,470/£1,575) of the National Joint Board Agreement for the Electricity Supply Industry. At the present rate of progress there are prospects that the classification of this District will be Class J in the not too distant future.

Applicants should be Chartered Electrical Engineers with experience in large Districts combining industrial, domestic and commercial loads on overhead and underground networks. They should be familiar with the problems of extensive reinforcement, planning and voltage standardisation and should be experienced in the control of all classes of labour.

Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, Assoc. I.E.E., Manager, Cardiff and East Central Area, South Wales Electricity Board, 445/447, Cowbridge Road East, Cardiff, so as to reach him not later than Saturday, 23rd January, 1960. 2825

NEW ZEALAND MINISTRY OF WORKS ENGINEERING STAFF

THE NEW ZEALAND MINISTRY OF WORKS invites applications for the following vacancies on the permanent staff. Positions, qualifications desired and salaries offered are as follows :—

Vacancy No. 3 :
MECHANICAL OR ELECTRICAL ENGINEERS.

Corporate Membership of the Institutions of Mechanical or Electrical Engineers, London, together with sufficient appropriate experience. Commencing salaries up to £1,525 p.a.

Vacancy No. 4 :
BUILDING SERVICES ENGINEERS.

Corporate Membership of the Institution of Heating and Ventilating Engineers, London. Commencing salaries up to £1,450 p.a.

Vacancy No. 5 :
ASSISTANT MECHANICAL OR ELECTRICAL ENGINEERS.

A University Degree in Mechanical Engineering or Graduate Membership of the Institutions of Mechanical or Electrical Engineers, London, together with at least five years' experience since commencement of pupilage. Commencing salaries £870 up to £1,060 p.a.

Vacancy No. 6 :
ASSISTANT BUILDING SERVICES ENGINEERS.

Graduate Membership of the Institution of Heating and Ventilating Engineers, London, with at least five years' experience since commencement of pupilage. Commencing salaries £870 to £1,060 p.a.

Experience is necessary in the design and installation of services or equipment for one or more of the following: heating and ventilating, air conditioning, hot and cold water or sewerage services, laundries, kitchens, boiler-houses, lifts and other mechanical services in offices, schools, hospitals, hotels, telephone exchanges, printing works, defence establishments, etc. All appointees will be required to undertake work of this nature.

Applicants must be resident in the United Kingdom or Eire and have fulfilled National Service obligations.

Enquiries, mentioning this publication and stating the vacancy number and the position sought, should be addressed to the High Commissioner for New Zealand, 415, Strand, London, W.C.2. Full details of duties, experience required, general information on the conditions of employment in the New Zealand Public Service and application forms will then be supplied. 2794

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following posts :—

FOURTH ASSISTANT ENGINEERS, SYSTEM OPERATION DEPT., THAMES NORTH GRID CONTROL, REDBOURN, Nr. ST. ALBANS, HERTS (S.V. No. 1207).

Salary N.J.B. Class AX/EX, within the range of Grade 7/8, £735 × £25 to £965/£1,065 per annum.

The commencing salaries will be within the above range at a point commensurate with qualifications and experience.

Applicants should have qualifications to Higher National Certificate standard and should be prepared ultimately to undertake shift duties in the Area Grid Control Room. Some steam generating station experience is desirable.

DIVISIONAL ASSISTANT CHEMIST, GENERATION DEPT. AT D.H.Q., COCKFOSTERS, NORTH LONDON (S.V. No. 1177).

Salary N.J.B. Class AX/DX, Grade 6, £975 × £25 to £1,100/£1,190 per annum inclusive of London weighting.

Applicants should possess a scientific qualification not less than Higher National Certificate (Chemistry) and should have considerable knowledge of the chemical services required by a generating station. Experience of the investigation of chemical problems is desirable and the ability to prepare concise reports is necessary.

Applications, quoting the appropriate staff vacancy number and reference 2/11129, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by the 16th January, 1960. 2789

DRAUGHTSMEN

DUE to further expansion a well-known company invites applications from Draughtsmen with electrical experience. Candidates should be educated up to H.N.C. or equivalent standard in engineering. A good commencing salary will be paid in accordance with experience and qualifications. The posts are pensionable with all the usual benefits of a large and modern industry.

Applications, which will be treated in strict confidence, giving full details of age, qualifications and experience, to—Box 2812.

RAILWAY ELECTRIFICATION

ASSISTANT FOREMAN (CLASS II) REQUIRED

Railway Male Supervisory Conditions of Service

Salary Range £637 - £672

EXPERIENCE in erection, repair and maintenance of overhead line contact systems. Should possess sound knowledge of safety precautions, electrical, mechanical and personnel.

The successful applicant will be temporarily located at Romford, Essex, but will be required to work in any section of the Eastern Region electrification.

Apply to :—

Electric Traction Engineer
British Railways, Eastern Region, Ley Street, Ilford, Essex

2781

SOUTH OF SCOTLAND ELECTRICITY BOARD

Area Secretary, Glasgow Area

APPLICATIONS are invited from persons suitably qualified and with practical experience in secretarial and administrative work for the above superannuable appointment.

The salary for the post will be within the range £1,940/£2,140 per annum in accordance with Grade 5, Class C of the National Joint Managerial and Higher Executive Grades Committee.

Apply, quoting reference number S16/59, on form AE.6, available from the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, not later than Thursday, 14th January, 1960. 2822

POST OFFICE : ASSISTANT ENGINEER

ABOUT 10 permanent and pensionable posts for men at least 17½ and under 23½ on 1st March, 1960, with extension for Forces Service, Overseas Civil Service and, up to two years, for established Civil Service. Written examination, beginning 5th, April, 1960, in English, Physics and two prescribed optional subjects, followed by interview of qualified candidates.

Salary (London) £560 at 18, 19 or 20, £620 at 21, £785 at 25 or over, rising to £1,205. Five-day week in general. Promotion prospects.

Write Civil Service Commission, Burlington Gardens, London, W.1, for application form, quoting 159/60. Closing date 28th January, 1960. 2838

Situations Vacant (continued)

SOUTH WESTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following position :—

FOURTH ASSISTANT ENGINEER,
Central Construction Department,
Taunton.

Salary according to Class AX, Grade 7, £840 × £25 to £965 per annum, with further progression to £1,040 (Class DX) of Schedule B of the N.J.B. Agreement.

Candidates should be experienced in survey, planning and supervision of construction of all classes of overhead lines and substations and the laying of underground mains up to and including 33 kV.

Possession of technical qualifications at least equivalent to the Ordinary National Certificate is desirable.

Applicants for this post should be prepared to be mobile throughout the Board's area, and will be based either at Taunton or at a convenient alternative centre. Travelling and subsistence allowances in accordance with the N.J.B. Agreement will be paid when working away from base.

Applications for the above post to be made on standard form AE6/ACT, obtainable by postcard only from the Establishments Officer, South Western Electricity Board, Electricity House, Colston Avenue, Bristol, 1. Closing date for receipt of completed applications is 16th January, 1960. 2836

NORTH THAMES GAS BOARD

requires an ELECTRICAL ENGINEER at its By-Products Works, Beckton, East Ham, London, E.6.

Applications are invited from engineers, between 30 and 40 years of age, who are experienced in heavy industrial or chemical works practice. Possession of the Higher National Certificate is the minimum qualification required.

The successful candidate will be responsible for all electrical services on the works and his duties will cover the erection and commissioning of equipment, modification of existing plant, maintenance of high-voltage generators, mercury arc rectifiers, substations (up to 22 kV), switchrooms and a wide variety of A.C. and D.C. equipment and services, including flameproof installations, in continuously operating process plants.

Experience in the control of skilled and semi-skilled labour is essential and a knowledge of planned maintenance will be an advantage.

Starting salary will be within the range of A.P.T. 11 (£986-£1,111).

Applications, giving full details, should be sent within ten days of the publication of this advertisement to the Staff Controller, North Thames Gas Board, 30, Kensington Church Street, London, W.8, quoting reference ER/794. 2823

BICC

SENIOR TECHNICAL ASSISTANT

required in London for work in connection with electrical transmission problems of all types from heavy current transmission at low voltage to high-voltage transmission on overhead lines. Ability to solve new problems in a practical way will be an advantage.

Applicants should not be over 35 years of age and should have a degree in electrical engineering or qualifications of equivalent standard.

Applications should be addressed to the Personnel Officer, British Insulated Callender's Cables Limited, Surrey House, Temple Place, London, W.C.2. 2861

MANAGER FOR WHOLESALER

OLD estab. elec. wholesaler seeks manager with wide experience of buying, stock control, selling, accountancy, transport, office organisation and staff control, etc., for West London branch. Box 2865.

JOSEPH LUCAS (ELECTRICAL) LTD.

require

SENIOR TECHNICAL ASSISTANTS

(with Higher National Certificate)

and

TECHNICAL ASSISTANTS

(with Ordinary National Certificate)

in their laboratories for interesting and progressive work associated with the development and testing of electrical equipment for motor vehicles. The laboratories are modern and well equipped and the positions provide excellent prospects for promotion. Opportunities for further part-time attendance at technical college can be provided for suitable candidates. Five-day week. Staff pension fund.

Apply in writing, giving full details of age, qualifications and experience, to the Personnel Manager, JOSEPH LUCAS (ELECTRICAL) LIMITED, Great King Street, Birmingham, 19, quoting reference PM/D/359.

2840

SOUTH EASTERN ELECTRICITY BOARD

DISTRICT COMMERCIAL ASSISTANT,
Dover District.

Salary £640-£700 p.a. under N.J.C. Grade 2. Superannuable. The person appointed must be fully experienced in modern installation practice and be able to prepare competitive quotations for both large and small installations. He must be conversant with the preparation of heating schemes and also water heating installations. A knowledge of appliances is also essential.

Applications, quoting ER, and naming two referees, to District Manager, SEEBOARD, Ladywell, Dover, by 20th January, 1960.

ASSISTANT DISTRICT ENGINEER,
Brighton and Hove District.

Salary £860 × £15 to £905 p.a. under N.J.B. Class H, Grade 10. Superannuable. Applicants should possess the H.N.C. in Electrical Engineering or its equivalent and have had training and experience in the construction, operation and maintenance of underground distribution systems up to 33 kV. Knowledge of D.C./A.C. change-over will be an advantage.

Applications, quoting ER, and naming two referees, to District Manager, SEEBOARD, Electric House, Castle Square, Brighton, by 20th January, 1960.

GEORGE WRAY,
Secretary. 2858

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

GENERAL ASSISTANT ENGINEER (Efficiency), required at Castle Meads Power Station, Gloucester.

Superannuation scheme. Salary N.J.B. Class E, Grade 11, £655-£700.

Duties will be of a general engineering nature in connection with efficiency, instrumentation, and technical records. Applicants should preferably possess a Higher National Certificate.

Previous applicants need not re-apply.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by 15th January, 1960. 2854

ELECTRICAL RESEARCH ASSOCIATION

GRADUATE with good degree in Electrical Engineering or Physics required in section dealing with problems concerning applications of electricity in HORTICULTURE.

Salary within range £700-£900 according to qualifications. Superannuation under F.S.S.U.

Applications to Head of Rural Electrification Department, E.R.A. Field Station, Shinfield, Nr. Reading, Berkshire. 2806

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

APPLICATIONS are invited for the post of ASSISTANT INSTRUMENT ENGINEER in the Steam Testing Department at North Tees "C" Power Station.

This engineer will assist in the maintenance of all types of instruments and associated control equipment on boilers, turbines and auxiliary mechanical plant.

Applicants should have served a recognised apprenticeship, have had a good technical education and should have some experience of work as a technician on comparable equipment.

The salary for the appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule A, Grade 12, Class J (£815-£860 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 30th January, 1960. 2788

THE RHODESIAN IRON AND STEEL COMPANY LIMITED

Power Station Superintendent

APPLICATIONS are invited for the position of POWER STATION SUPERINTENDENT at the Company's Works at Redcliff, Southern Rhodesia, to take control of a small industrial power station with an initial generation of 2,500 kW, together with blast furnace turbo-blowers, boiler plant and electrically driven compressors.

Minimum qualifications required : Corporate membership of a recognised institution of electrical engineers or certificated engineer.

Starting salary not less than £2,000 per annum (inclusive).

The company offers assisted passages for successful applicant and his family and liberal leave conditions, pension and medical aid schemes. Married and single accommodation is available.

Applications should be addressed to Merz & McLellan, 32, Victoria Street, London, S.W.1, to reach them not later than 20th January, 1960. The appointment will be made very soon after that date. 2790

SUPERVISING ELECTRICAL ENGINEER

required for the London head office of a well-known electrical contracting organisation to handle contracts throughout the U.K.

It is essential that applicants have extensive experience in this field, preferably with a contracting company.

This is a senior position and applications will not be considered from foremen and chargehands.

Commencing salary up **to £1,750 p.a.** according to experience.

Please write giving full details to—Box 2863.

NORTH EASTERN ELECTRICITY BOARD

Tees Sub-Area

APPLICATIONS are invited for the appointments of THIRD ASSISTANT DISTRICT ENGINEER in each of the following districts: Darlington, Middlesbrough and Stockton. Applicants should be suitably qualified electrical engineers with sound practical training and experience in construction, operation and maintenance of overhead and underground networks and associated plant and equipment.

Salary for each post, Schedule A, Class F, Grade 9, £815/£860 per annum. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 2859

ASSISTANT ELECTRICAL ENGINEER

A VACANCY exists for an Assistant for our Chief Electrical Engineer. He will be chiefly concerned with the installation and maintenance of electrical equipment at our Southall Mill.

Applications are invited from qualified men who have had several years' experience covering repair and maintenance schemes for motors, sequence interlocking schemes, and electronic control. A good knowledge of automatic process control will be advantageous.

This is a permanent position and the company operates pension and life assurance schemes.

Please apply, stating full details of career to date to:—

Personnel Manager (AE.14)
QUAKER OATS LIMITED
Bridge Road, Southall, Middx.

2826

EAST MIDLANDS ELECTRICITY BOARD

Northamptonshire Sub-Area

APPLICATIONS are invited from suitably qualified and experienced persons for the following position:—

FOURTH ASSISTANT ENGINEER
(Shift Operation).
(Vacancy No. 127/59).

Salary N.J.B. Class K, Grade 12, £860 × £15 to £905 per annum, plus shift allowance.

Candidates should have had experience of switching operations on a high voltage distribution system, preferably including both urban and rural networks. Experience in the issue and cancellation of permits to work under the C.E. Safety Rules, or acting as Control Engineer for part of a high voltage system, would be an advantage.

Applications stating age, education, experience, qualifications, present position and salary and quoting the above vacancy number, should be forwarded to the Manager, Northamptonshire Sub-Area, 25, Bridge Street, Northampton, within fourteen days of the date of this advertisement. 2857

DESIGN DRAUGHTSMAN

required by progressive firm of switchgear manufacturers. Applicants should have the experience and ability to design a range of low-tension air break circuit breakers up to 36 MVA and 2,500 amps.

The vacancy offers good prospects for the right applicant.

Housing available. Pension scheme.

Write giving full details of age, experience and salary required to Personnel Manager.—Box 2742.

SALES REPRESENTATIVE

JOHNSON & PHILLIPS Limited wish to engage a suitably experienced SALES REPRESENTATIVE for their Bristol branch primarily for the sale of electric cables in the West Country.

Applications giving full details of experience to:—

Employment Manager
JOHNSON & PHILLIPS LIMITED
Victoria Way, Charlton
London, S.E.7

2839

ELECTRICIANS

ELECTRICIANS required for general maintenance and installation work on large integrated iron and steel works. Excellent conditions. Pension scheme in operation.

Apply to the Employment Officer, Appleby-Frodingham Steel Company, Scunthorpe, Lincs. 2864

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

Second Assistant Engineer (Civil)

APPLICATIONS are invited for the appointment of SECOND ASSISTANT ENGINEER (Civil) in the Midlands Project Group.

Applicants should have had experience in the design and construction of power station or other industrial buildings and ancillary work, together with experience in billing, measuring and estimating civil engineering and building works. They should preferably hold an appropriate qualification.

The salary will be within Grade 4, £1,195-£1,545 per annum of Schedule C of the National Joint Board Agreement.

Applications should be made on standard form AE6, available from the Administrative Officer, Midlands Project Group, 53, Wake Green Road, Moseley, Birmingham, 13, and should be returned to him not later than 18th January, 1960.

Envelopes should be marked "Confidential Staff Vacancy Notice No. MPG. 153/59. 2835

ELECTRICAL DRAUGHTSMAN (Senior)

required by KODAK Limited, with experience in the field of general distribution and utilisation. Qualifications and experience should be to H.N.C. standard or equivalent. The company has approximately 5,500 employees at its Harrow factory and operates non-contributory sickness and pension schemes and a part-contributory life insurance plan.

Please write for application form to:—

Men's Personnel Department
KODAK LIMITED (FACTORIES)
Wealdstone, Harrow, Middlesex

2849

ELECTRICAL ENGINEER

required for a group of mining companies in WEST AFRICA. In addition to a sound knowledge of industrial switchgear and general electrical equipment, applicant must have an intimate knowledge of modern electric winding engine control systems, including Ward Leonard, A.C. and dynamic braking.

Salary according to experience and qualifications, but would not be less than £1,500 p.a. Tours of 15 months with three months' leave on full pay. Provident fund, free accommodation and medical attention.

Applications will be treated in strict confidence. Write giving full details to

WEST & SOUTH AFRICAN MINING SERVICES LTD.
120, Moorgate, London, E.C.2

2778

CONTACTOR ENGINEER/DESIGNER

required by progressive company.

The position offers prospects for advancement and is pensionable.

Housing available.

Write giving details of age, experience, etc., to—Box 2743.

LONDON COUNTY COUNCIL

S.E. London Technical College

GRADE B LECTURER in Electrical Engineering required to teach up to I.E.E. Part III standard. Facilities for approved research, if desired.

Salary within the range £738 to £1,486 p.a. Commencing salary and maximum according to age, qualifications and experience.

Application forms from Secretary at College, Lewisham Way, London, S.E.4, returnable within 2 weeks of advertisement date. (2785) 2791

BRITISH Enka LIMITED

ENGINEERING DIVISION CONCERNED WITH MAN-MADE FIBRES AND FILMS

have vacancies for

SENIOR & JUNIOR DRAUGHTSMEN

in the following departments:—

MECHANICAL
BUILDING
ELECTRICAL

Experience in any of the above is essential and chemical works experience would be an advantage. The work involved is of a varied and interesting nature. Salaries up to £1,000 according to age and experience. Contributory pension scheme with facilities for transfer. Five-day week.

Applications giving full details of qualifications and experience to Personnel Manager, British Enka Ltd., Aintree, Liverpool, 9.

2862

SOUTH OF SCOTLAND ELECTRICITY BOARD

Ayrshire Area

APPLICATIONS are invited for the post of SECOND ASSISTANT DISTRICT ENGINEER in the Mauchline District of this Area.

Applicants should preferably be Chartered Electrical Engineers and have had an extensive training with experience in overhead and underground systems up to 33 kV, including the operation and maintenance of H.V. and L.V. switchgear, a knowledge of protective gear and fault location.

The salary for the post, which is superannuable, will be in accordance with the National Joint Board Agreement, Schedule A, Class E, Grade 7, £860/£905 per annum.

A house can be made available to the successful applicant.

Applications on the standard form should be returned duly completed with any additional information to Mr. G. F. Moore, Manager, Greenholm Street, Kilmarnock, not later than 15th January, 1960. 2741

SALES ENGINEER

HADDON TRANSFORMERS Ltd. wish to engage a suitably qualified and experienced Engineer for negotiating the sale of Transformers and Saturable Reactors, 1-250 kVA, to industrial purchasers in the London and Home Counties areas.

Applications in confidence, giving full details of experience, to:—

The Managing Director
HADDON TRANSFORMERS LTD.
Victoria Park Industrial Estate
Field End Road, Ruislip, Middlesex

2805

OFFICE AUTOMATION ENGINEERS

WONDERFUL opportunity for men skilled in high-speed mechanical equipment and electrical circuitry to service the very latest Data Processing Equipment. These positions are extremely interesting and offer splendid prospects—in view of the increasing application of office automation throughout commerce and industry. Full machine training given; appointment early New Year.

Write, in strictest confidence, to Friden Sales Manager, Bulmers Business Machines Ltd., 47-51, Worship Street, London, E.C.2. 2796

ASSISTANT branch manager required by electrical wholesalers in Sussex. Permanent and progressive position for man with wide wholesaling experience. Write stating age, experience and qualifications. Commencing salary in region of £600 per annum, pension scheme, etc.—Box 9885.

Situations Vacant (*continued*)

AN electro-mechanical draughtsman required by engineering company. Must be capable of detailed design and systematic handling of various projects. 5-day week, canteen, pension fund. Apply in writing stating age, previous experience, qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 324

AN engineering insurance company requires an engineer for appointment as inspecting engineer of electrical plant. Candidates must possess H.N.C. in Electrical Engineering or equivalent and have served an apprenticeship with a manufacturer of electrical machinery. Apply in own handwriting to the National Boiler and General Insurance Co. Ltd., St. Mary's Parsonage, Manchester, 3, giving age (limits 26 to 33), training and experience, academic qualifications and copies of testimonials. Salary £800-£1,100 (progressive). Non-contributory pension scheme. 2841

APPLICATIONS are invited from ambitious and resourceful men to fill the position of technical assistant to the sales manager of electric lamp machinery manufacturers near London. A permanent, progressive and interesting job is offered to the right person, who must possess a sound engineering and commercial background in the trade. Applications with full particulars of education, experience and salary required to —Box 328.

AUTOMATION, circuitry engineer, also draughtsman, for contactor electric control gear for automation and related schemes including control of machine tools, conveyors, etc. Estimating experience an advantage (engineer). Permanent position, H.N.C. and O.N.C. respectively (or equivalent qualifications) preferred. Good starting salary with excellent prospects of progressive remuneration. Write in confidence, giving full details of previous experience, qualifications, age and salary expected, to Technical Director, The Donovan Electrical Co. Ltd., Stechford, Birmingham, 33. 2808

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., Longridge House, Manchester, 4. Electrical surveyor required. Permanent position carrying progressive salary scale £800 to £1,100 and non-contributory pension. Candidates, aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. 2797

BRITISH LUMA require a foreman for their fluorescent tube department. Excellent opportunity for intelligent man in developing field. Experience of fluorescent production essential. Write stating age and experience to Manager, British Luma, Hardgate Road, Glasgow, S.W.1. 2842

CHIEF inspector required for cable works manufacturing rubber and plastic cables, cordages and wires, mainly for the telecommunication industry. Experience of the various Government inspecting procedures essential. A knowledge of modern manufacturing methods and testing techniques would also be an advantage. Write details to—Reliance Cords & Cables Ltd., Staffa Road, Leyton, London, E.10. 9884

CIRCUIT draughtsman. Young man, age 22/35, required for circuitry work associated with automatic control gear. O.N.C. standard preferred. Permanent and progressive position. Pension fund, canteen. Apply in writing giving full details of age, experience and qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 320

CONSULTING engineers have vacancies for experienced electrical draughtsmen for lighting and power installations in all classes of buildings, including nuclear energy field. Good salary and pension scheme. Write in first instance to E. G. Irwin & Partners Ltd., 2, Princes Row, Buckingham Palace Road, London, S.W.1. 9867

ELECTRICAL department of large group of companies requires draughtsmen for interesting work on new projects. Applicants should have experience in distribution, control and utilisation of electric power, and should be of Ordinary National standard at least. The posts offer scope for advancement within the group. Five-day week. Pension scheme. Canteen and social club facilities. Apply, giving details of age, experience and salary required to Personnel Manager, T.I. (Group Services) Limited, Rocky Lane, Aston, Birmingham, 6. 2809

CIRCUIT engineer required for development work. Previous experience of control gear desirable. Minimum academic qualifications, H.N.C. Permanent and pensionable position. Please write giving full details of age, experience, etc., to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 323

CONTROL gear engineer required. Age 23/35. For layout and circuiting of contactor equipment. Experience of lift equipment would be an advantage. Permanent and progressive position. Good salary. Canteen, pension fund. Write stating age, experience and qualifications, if any, to Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 322

DRAUGHTSMEN required for consulting engineers' office, to assist in the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required to—J. Roger Preston & Partners, 15, North Audley Street, London, W.1. 2866

ELECTRICAL engineer required by London consulting engineers for preparation of design, specifications, etc., for schools, hospitals and commercial buildings, etc. Write stating age, experience, qualifications and salary required to—Box 160.

ELECTRICAL engineer required for London consulting engineers' office. Applicants should be Associate Members of the I.E.E. and experienced in the complete design of electrical services in hospitals, universities, colleges, etc. —Box 2773.

ELECTRICAL engineer required for head office staff. Degree or graduate membership of I.E.E. and practical training at manufacturer of electrical machines. Upper age limit 35. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler & Electrical Insurance Co. Ltd., Longridge House, Manchester, 4. 2798

ELECTRICAL engineer required, to be responsible for the design and installation of electrical equipment in major development schemes. The work is concerned with plants for the handling and processing of roadstone materials. Candidates with experience in the quarrying or allied industries are preferred. Written applications containing full details should be made to the Development Manager, Tarmac Roadstone Limited, Ettingshall, Wolverhampton. 2810

ELECTRICAL eng. company have vacancy for young draughtsman in their engineering dept. Experience in the design and development of lighting fittings preferred. Apply in writing to the Chief Engineer, Lamps and Lighting Division, Siemens Edison Swan Limited, 38/39, Upper Thames Street, London, E.C.4. 2813

ELECTRICAL engineers required for consulting engineers' office, to carry out the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required, to—J. Roger Preston & Partners, 15, North Audley Street, London, W.1. 2867

ELECTRICAL engineer-surveyor for inspection of electrical plant. Must possess H.N.C. and have general practical experience. Resident Yeovil or near. Commencing salary £800 rising to £1,100 (E.S.A. scale). Pension, etc. Apply Eng. Dept., General Assurance Corp. Ltd., 99, Aldwych, London, W.C.2. 2843

ELECTRICAL wholesalers require live representative for Bristol branch. Applicants must have thorough knowledge of trade and previous experience with electrical wholesalers. High salary and commission with non-contributory pension. State age and past experience.—Box 2829.

ELECTRICIAN/electrical mechanic, first class, experienced installation work, required by large electrical concern; 12 months' service overseas. Excellent opportunity. Write experience, age, references.—Box 2828.

ENGINEER with electrical and mechanical background and some sales and administrative training to act as assistant to the managing director of London contractors with view to directorship. Please state age and experience.—Box 189.

ELECTRONIC engineer required with experience in the application of transistors to control circuits. Some knowledge of protection and control schemes would be an advantage. Apply giving full particulars of age, training and qualifications and subsequent experience to the Chief Engineer, A. Reyrolle & Co. Ltd., Hebburn, Co. Durham. 2814

EXCELLENT prospects for contract engineers and supervisors experienced in electrical cable work, overhead line transmission and installations, Midlands and Southern England. The aim of the company is expansion with obvious promotion opportunities. Apply giving full particulars. Early interviews arranged. —Box 325.

EXPERIENCED maintenance electrician required by medium-sized works, with good knowledge of A.C. automatic equipment. Capable of small installation work if required. Send references and full details of experience. —Box 2815.

FIRM of 40 years' standing requires representative already calling on electrical trades, electricians, electrical factors, etc. Good repeatable lines. Very attractive commission. Districts: S. Wales, N.W. England, Midlands, S.W. England, Scotland, London and Southern Counties.—Box 2774.

JUNIOR sales engineer to operate from Manchester sales office of control gear manufacturers. Promotion to full outside status later. State fully experience, present salary and salary expected to—Box 2834.

PLUMBER jointers, H.V. and L.V., required for contracting work. Applicants should be willing to undertake a trade test.—Box 2868.

PRODUCTION manager required, aged 33/45; apprentice served and with H.N.C. in electrical engineering; to control small Wolverhampton works making high-quality control gear and electro/mechanical products on a batch and one off basis. Must have had minimum of 5 years' practical work study methods and works control experience of this type of work and be able to see jobs through from D.O. to dispatch. Opportunity for hard-working practical engineer prepared to be judged on results.—Box 2811.

REQUIRED for large coal mining organisation in Chile, South America: Assistant chief electrical engineer. Applicants must have wide experience of planning and maintenance of mining equipment and of the application of planned maintenance schemes. Duties will also include taking charge of all underground mechanical and electrical installations. Applicants should preferably possess qualification of A.M.I.E.E. Knowledge of Spanish an advantage. Prospects for future advancement extremely favourable. Apply in writing for application forms to the Chief Engineer, Powell Duffryn Technical Services Ltd., 19, Berkeley Street, London, W.1. 2783

SALES. A vacancy exists in the sales department of a well-known firm of electric motor manufacturers. Theoretical and practical training essential. Good prospects for advancement. Age 21 to 30. Apply in confidence stating age, experience and salary required.—Box 2831.

SALES engineer required by control gear manufacturers. Age 28/35 years. Required to operate in Yorkshire area. Salary, expenses, pension scheme and car provided. Write fully giving age, details of past history, salaries earned and expected to—Box 2830.

SALES engineer required for London area by electrical equipment manufacturers. Should have good technical knowledge of motor control gear and associated equipment. Interviews will be arranged in London during January. Please reply giving full details to—Box 2844.

SENIOR draughtsmen required for the electrical drawing office of large steelworks. The position gives valuable opportunity to applicants having varying degrees of experience. Commencing salary will be in accordance with ability and previous experience in steelworks electrical design and installation work. Applications should be addressed to the Labour Manager, Samuel Fox & Company Limited, Stocksbridge Works, Nr. Sheffield. 2869

SERVICE engineer required for motors and automatic control gear, age 23/26 years. Apply stating qualifications and experience.—Box 9894.

STOREKEEPER required, able to drive. Must have experience with electrical contractors. London S.W.1 area. 5-day week.—Box 2871.

SENIOR transformer designer, with a wide experience covering units used in the electronic and industrial field up to 500 kVA. Preferably with drawing office experience. Directorship would be offered after probationary period. Apply — Stewart Transformers Ltd., 75, Kilburn Lane, London, W.10. 2870

SUPERVISOR or foreman required for electrical contracting business. Fully experienced in handling medium-sized contracts. Some knowledge of pricing an advantage. Write giving full details of experience and salary required to—Hamilton Cole (Sussex) Ltd., 201, Heene Road, Worthing, Sussex (Telephone, Worthing 1961/1887). 2872

TECHNICAL assistant, electrical, aged 24/30, required by a large and expanding company in S.E. Essex Thameside area. Candidates should have completed a recognised training period in industry, have a good knowledge of A.C. and D.C. circuits, and educated to H.N.C. (Elect.) or equivalent standard. Good prospects and remuneration. Please send full details in confidence to—Box 2799.

TECHNICAL representative (25 to 40) required to call on architects, consultants and contractors in Lancs and Cheshire. Knowledge of power distribution systems essential. Design experience an advantage. Please state salary required, age, qualifications and experience to —Box 2816.

TECHNICAL sales representative, aged 28-35, required by Lewis Berger (Great Britain) Ltd. for their insulating varnishes division. Knowledge of electrical insulating materials and experience in the radio industry would be advantageous. Good appearance and sound educational background essential. Pension scheme. Car provided. Applications giving full details of age, experience and qualifications to Personnel Officer, Freshwater Road, Dagenham, Essex, quoting Ref. No. 980. 2845

TREFOREST ELECTRICAL SERVICES Ltd., Aberbargoed, Mon., have vacancies for draughtsmen, preferably with experience in design or low-tension switchfuse or motor-controlled gear. Consideration will be given to applicants with good mechanical experience and are prepared to be trained in the electrical field. Housing available to suitable applicant. Applications giving particulars of age, experience, etc., to the Personnel Manager. 2744

TWO assistant electrical engineers required by large firm architects Central London; H.N.C. or O.N.C. standard only. Apply giving personal details, education, experience, salary required.—Box 2817.

VACANCY occurs, due to retirement of partner, for supervisor to assist remaining partner in small contracting firm. Write stating age, experience, salary required.—Box 9887.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

CHARTERED electrical engineer (38) with export sales experience seeks position as commercial executive with switchgear/motor/transformer/electronics manufacturer in Surrey area. Prepared to invest some capital.—Box 9888

ELECTRICAL fitter (35), O.N.C., apprenticed, prepared to travel for progressive post. Write—Harris, 708, Christchurch Road, Bournemouth. 9892

ELECTRICAL wholesale general sales manager, aged 40, unable to progress in present capacity, seeks position where unstinting effort will show financial advancement on present salary of £1,600. Contacts are on South Coast but would move.—Box 9893.

ELECTRICIAN (29), apprentice trained, requires progressive position.—Box 9889.

MANUFACTURERS' representative, contacts wholesalers, retailers, users, London area, desires change.—Box 9895.

SALES manager, A.M.I.E.E., public school (42), works trained, seeks change. Top contacts industry and boards in South, handling switch and control gear, also motors, electronics, installation work. About £1,750.—Box 9882.

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VARIABLE SPEED MOTORS FOR 400/440/3/50 SUPPLY

No.	H.P.	R.P.M.	Make.	Price (each).	
8	2.48/0.13	2000/100	SIEMENS	£55	(b)
1	2.5 /0.13	2000/100	E.E.C.	£55	(b)
3	2.95/0.13	2000/100	SIEMENS	£60	(b)
13	3.0 /1.8	2200/137	B.T.H.	£60	(b)
4	7.5 /0.32	2500/125	ASEA	£105	(a)

Little used and in excellent condition.

(a) Remote Control. (b) Manual Control.

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CHAINS of every type and finish for suspending fittings, etc.; Hooks, Rings and Wire forming.

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200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

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221, City Road, London, E.C.1 37

600

VARIABLE SPEED DRIVES, 415/3/50 INPUT

H.P.	Speed.	Maker.	Remarks.
0/525	0/1000	G.E.C.	Ward Leonard
0/340/340	0/1200/1600	E.E.C.	" "
0/275/275	0/1500/1800	E.E.C.	" "
67.5/270	95/370	B.T.H.	Schrage Motor
0/200/200	0/750/960	G.E.C.	Ward Leonard
0/150/150	0/1000/1700	BRUSH	" "
0/130	0/1000	L.S.E.	" "
35/70	650/1300	B.T.H.	Remote C. Schrage
0/60	0/1500	ALLEN	Ward Leonard
0/50/50	0/2000/2900	E.E.C.	" "
0/45	0/2700	L.S.E.	" "
20/40	500/1000	B.T.H.	Schrage
0/33/33	0/1200/1500	MAWDSLEY	Ward Leonard
0/20/26	0/2000/2500	E.E.C.	" "
4.5/21	400/1450	FULLER	Schrage

Prompt despatch all covered by guarantee.

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OIL-COOLED TRANSFORMERS

kVA	Primary	Secondary	Maker	Remarks
600	6600	400/3/50	B.E.T.	Delta/Star
440	6350	400/3/50	G.E.C.	" "
400	3300	440/3/50	G.E.C.	" "
300	6500	465/3/50	HACKBRIDGE	" "
300	3300	450/3/50	B.T.H.	" "
200	400	200	YORKSHIRE ELECT.	Star/Auto
200	11000	433	THERMO CONTROL	Delta/Star
150	10750	440/3/50	FOSTER	" "
150	6600	420/3/50	YORKSHIRE	" "
100	11000	415/3/50	S. WALES SWITCHGEAR	" "
50	3300	400/3/50	HACKBRIDGE	" Several available
32	400	200/400/3/50	BRENTFORD	Variable voltage
30	3300	400/3/50	HACKBRIDGE	Delta/Star
10	3300	400/3/50	MET.-VICK.	" "
10	400/1/50	20/40	B.E.T.	Air cooled variable voltage
6	400/1/50	10/20	B.E.T.	" " " "

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A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd., London W4. 57

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 4487). 169

ALTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

ALTERNATORS from stock, ½ kVA to 150 kVA, single-phase and three-phase, overhauled and guaranteed. Reasonable prices.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts. 2875

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STANDARD A.C. MOTORS, 415/3/50, PROTECTED FRAME, BALL/ROLLER BEARINGS

H.P.	Speed	Make	Remarks
125	2900	CLARKE CHAPMAN	Squirrel Cage
120	720	BROOK	Slipring
100	485	BROOK	Slipring
90	725	MET.-VICK.	Slipring
60	970	E.E.C.	Slipring
50	725	E.E.C.	Slipring
40	960	HOLMES	Slipring
40	1440	C.P.	Squirrel Cage
35	1460	BROOK	Slipring
35	960	BROOK	Slipring

Starting Gear available.
Prompt Delivery, covered by Guarantee.

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PREPAYMENT and credit, 200/250 v. A.C., s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
87/89, Sterte Avenue, Poole, Dorset
(Tel.: Poole 272)
371, West Green Road, Tottenham, London, N.15 (Tel.: Bowes Park 7080) 191

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NEW CROMPTON PARKINSON, from ½ h.p. to 80 h.p.; also 6,000 A.C. and D.C. reconditioned Motors and Starters.

IN STOCK HERE

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A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A number of self-contained arc welding sets consisting of Meadows Petrol engine, generators, switchboards, etc., suitable for electrodes sizes 6-14. Excellent condition. Price £165 each.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford (B.S. 1000/1). 2874

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

AUTO-synchronous motors, 2 available, 50 h.p., 1,000 r.p.m., by Crompton Parkinson, 400 v., 3-phase, 50 cycles, with starters. Further details from—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park. 79

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists.—Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

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ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

EXCELLENT condition: Higgs 5-h.p., 415-v., 3-phase induction motor, complete with B.T.H. star/delta starter. £25.—Crossthwaite, 1, Felbridge Place, East Grinstead, Sussex. 9883

FLUORESCENT tubes reconditioned and guaranteed as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks.—Anglo-American Electrical Company, Olive St., Bury (Phone, Bolton 7251). 212

FOR quality fluorescent fittings, trunking systems, tubes and control gear contact Anglo-American Electrical Company, Olive St., Bury (Phone, Bolton 7251). 213

FOR sale, good, unused and used machinery, including electric motors, A.C. and D.C., dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

FRACTIONAL h.p. motors, new, ex stock, A.C./D.C., Universal, B.T.H., Delco-Remy, G.E.C., Fracmo, Newman, Scophony.—Jeary Electrical Co. Ltd., 5, Lamb's Buildings, London, E.C.1. 126

GEARED motors, 35 h.p., 730/45 r.p.m., B.T.H. slipring, T.E.F.C., 400 v., 3-phase, 50 cycles, with fully automatic Brookhirst panels and power plant reduction gear. Further details from—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park. 80

GENERATING sets, portable or stationary, new and reconditioned, 1 to 100 kW, A.C. and D.C.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 148

HEENAN & Froude dynamometer, size DP5. Range 50 h.p., 450/3,500 r.p.m. to 700 h.p., 1,600/3,500 r.p.m. Excellent condition, £185.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts. 2876

KARDEX, Roneodex and Shannovue cabinets, as new.—F. H. Jolly & Co. Ltd., 289, King St., London, W.6 (RIV. 5381). 202

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS and control gear, huge stocks all types, ¼ to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (3774/5/6). 70

NAMEPLATES, engraving, diesinking, stencils.—Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

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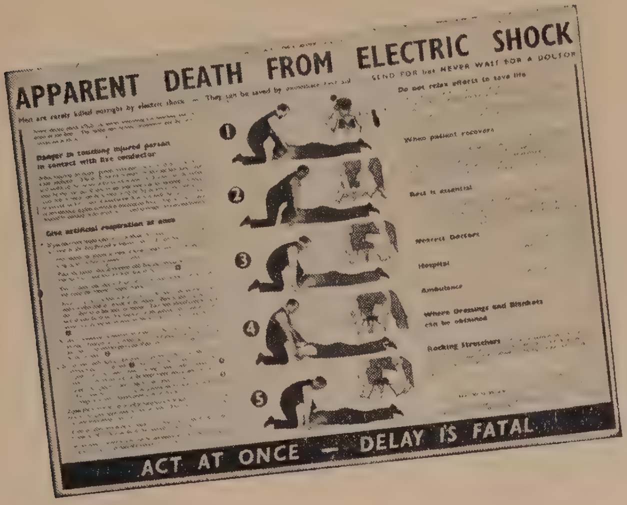

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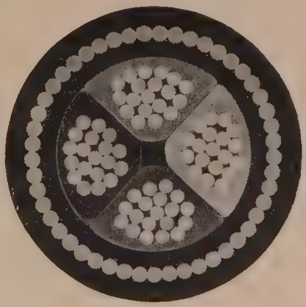

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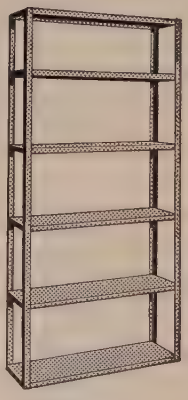

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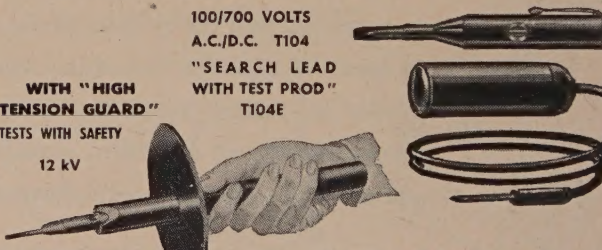

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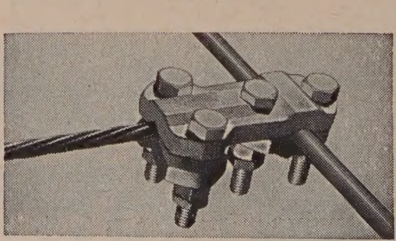

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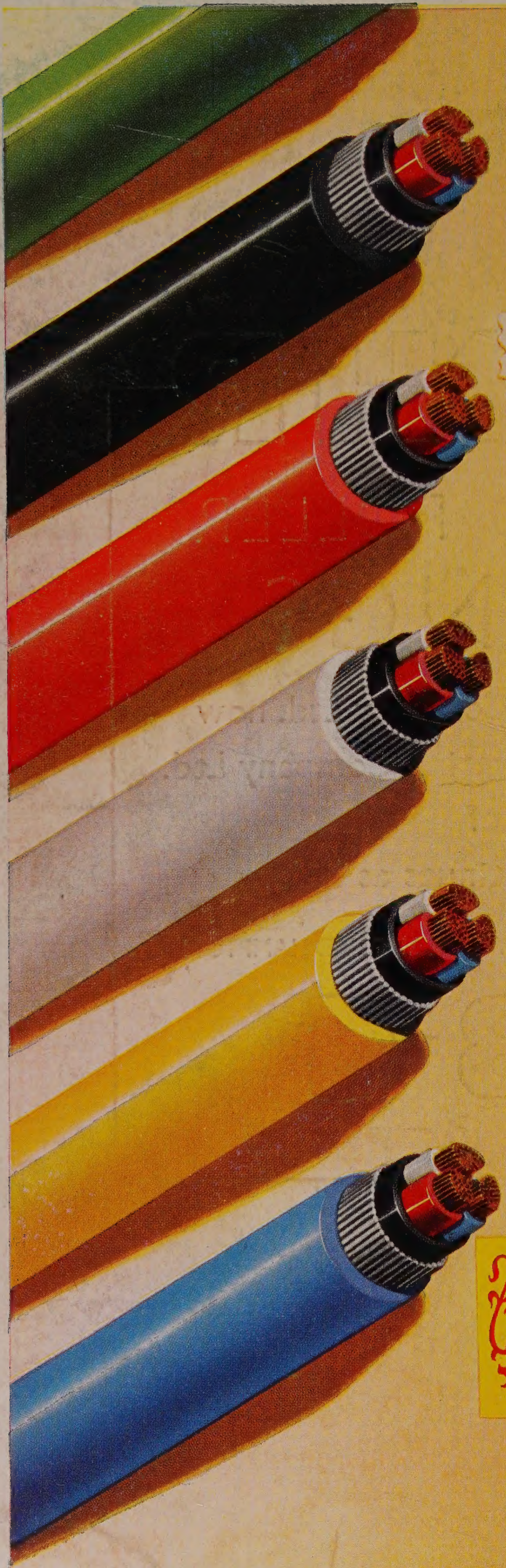

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As the diversity of electrical services grows and the complexity and number of circuits increases, the necessity for rapid identification becomes of paramount importance. It is in this field that P.V.C. sheathing instantly commends itself, obtainable as it is, in a wide range of colours and shades which are both decorative and permanent. The ease with which cables sheathed with coloured P.V.C. can be identified, coupled with the fact that this identification can be continued throughout the entire length of the circuit, is a safety factor where electrical maintenance personnel are concerned which no employer should overlook.

P.V.C. Sheathing can be applied to most types of cable—paper, rubber, or plastic insulated—armoured or unarmoured—and its superiority as a sheathing medium where corrosive atmospheres are present, is well known.

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